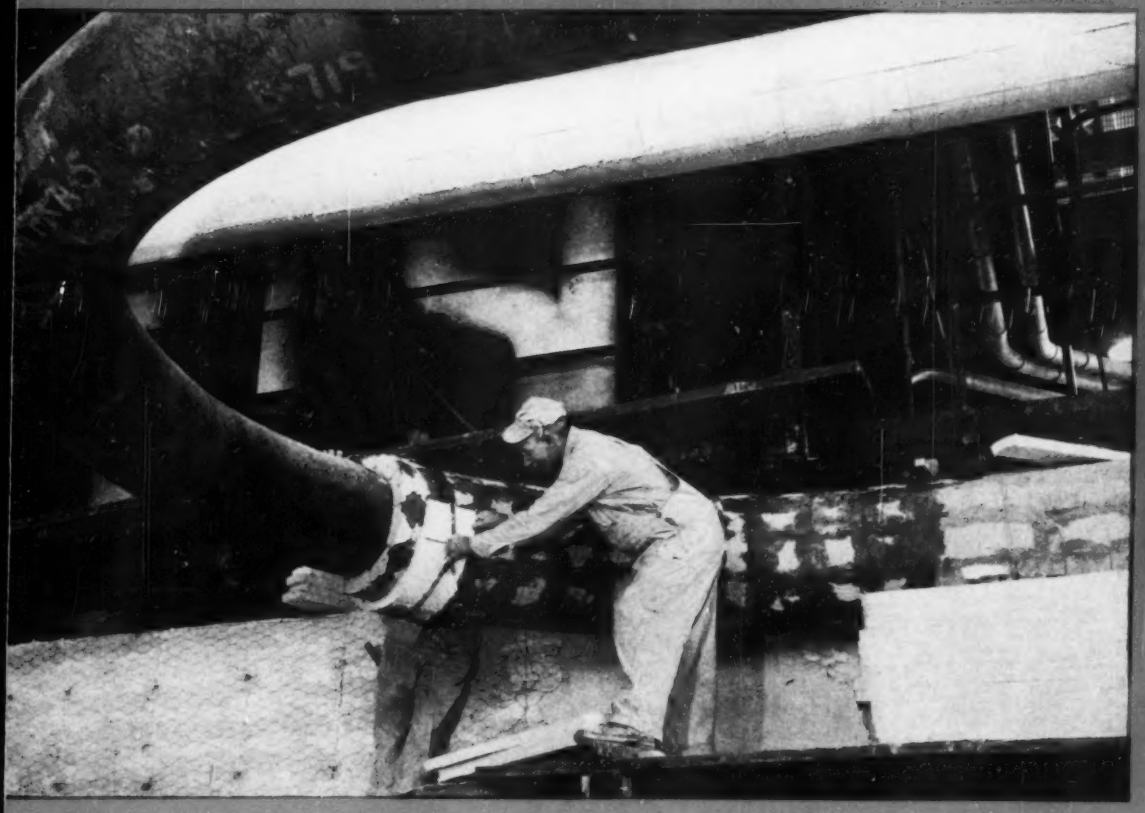
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

MARCH ★ 1950

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 111—Journal Section of the American Society of Heating and Ventilating Engineers



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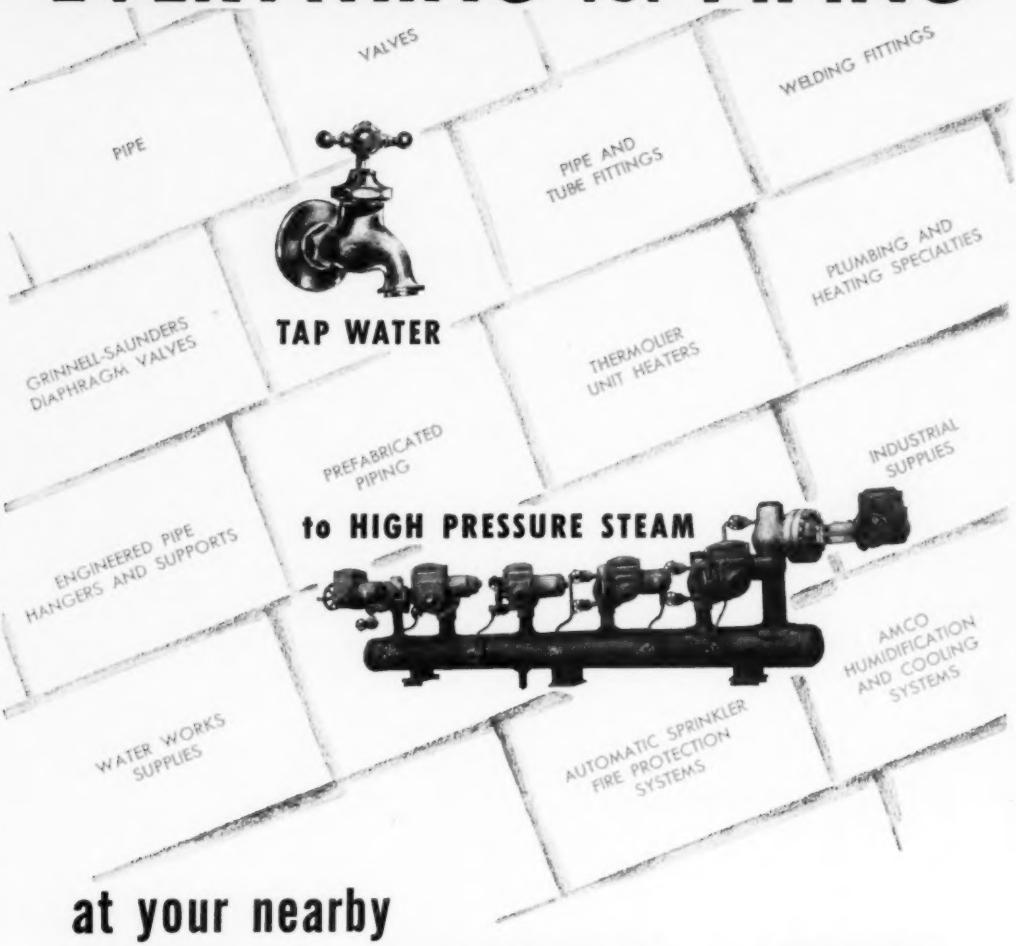
EVERYTHING for PIPING



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What really got them excited was that all the hundreds of Modu-aire units went in without an inch of expensive ductwork! There was no wholesale ripping out of walls or partitions . . . no valuable space wasted on huge supply ducts. Rentable guest rooms were out of service only three or four at a time . . . and only for a day or two at the most . . .

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Modu-aire is the one ideal answer to the puzzler of air conditioning existing buildings. The system is simply a series of small, powerful air conditioning plants connected to a central coolant source by simple plumbing pipe.

They cool with chilled water from a well or cooling machine or with Freon. They heat with steam or heated water. Units may be recessed beneath windows (as at the Chase) or may be freestanding models.

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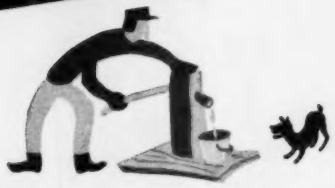

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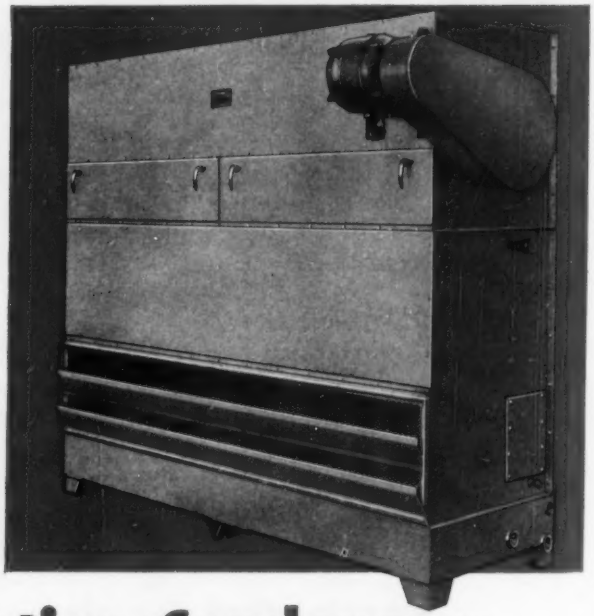
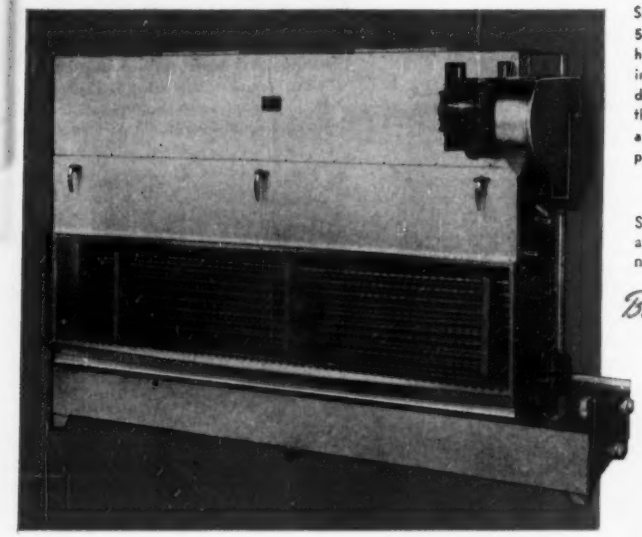


BUSH Evaporative Condensers



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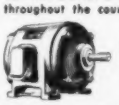

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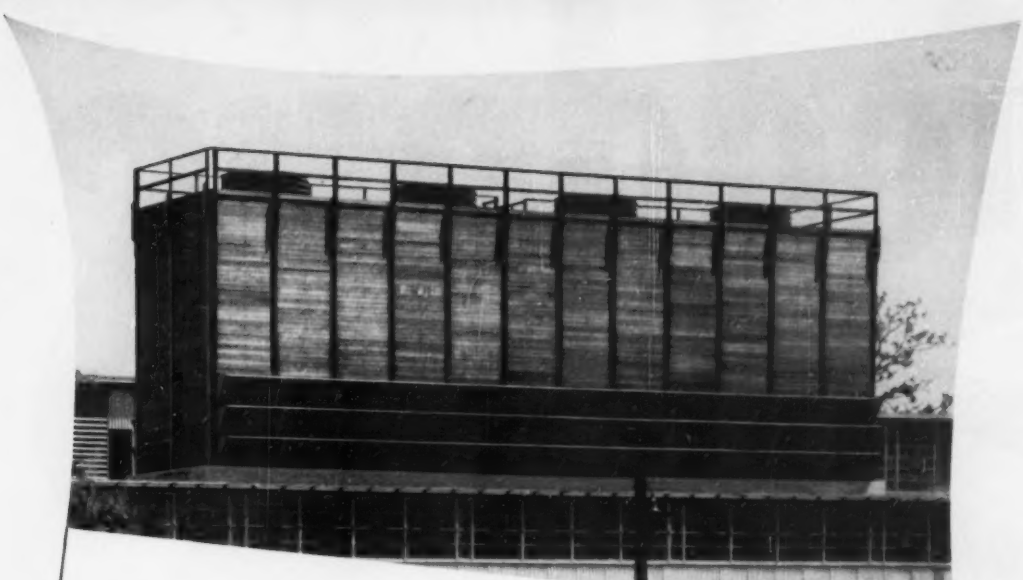

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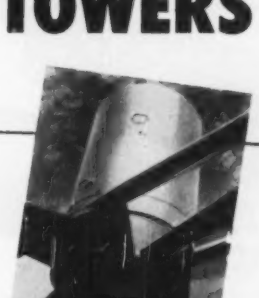

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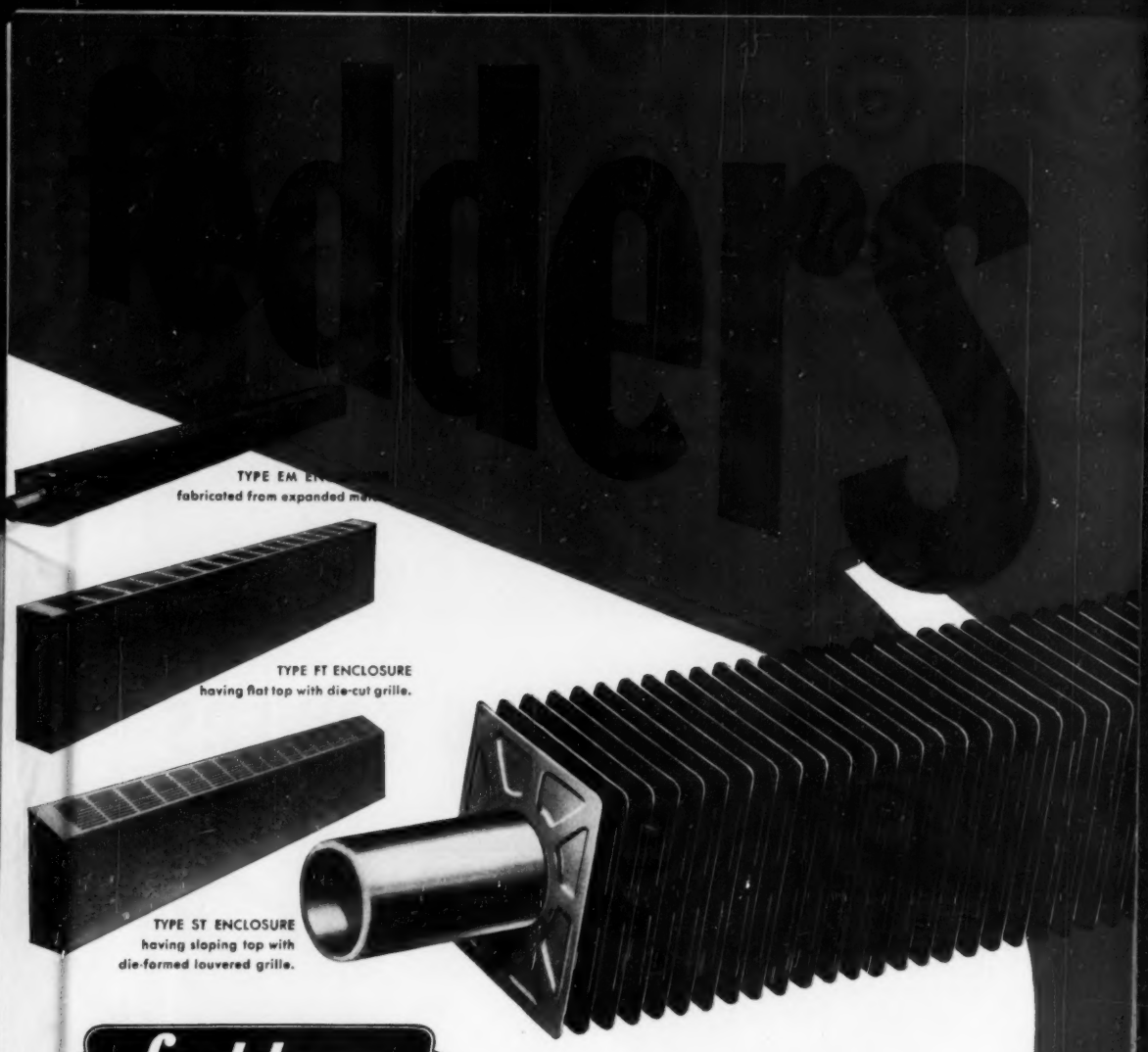

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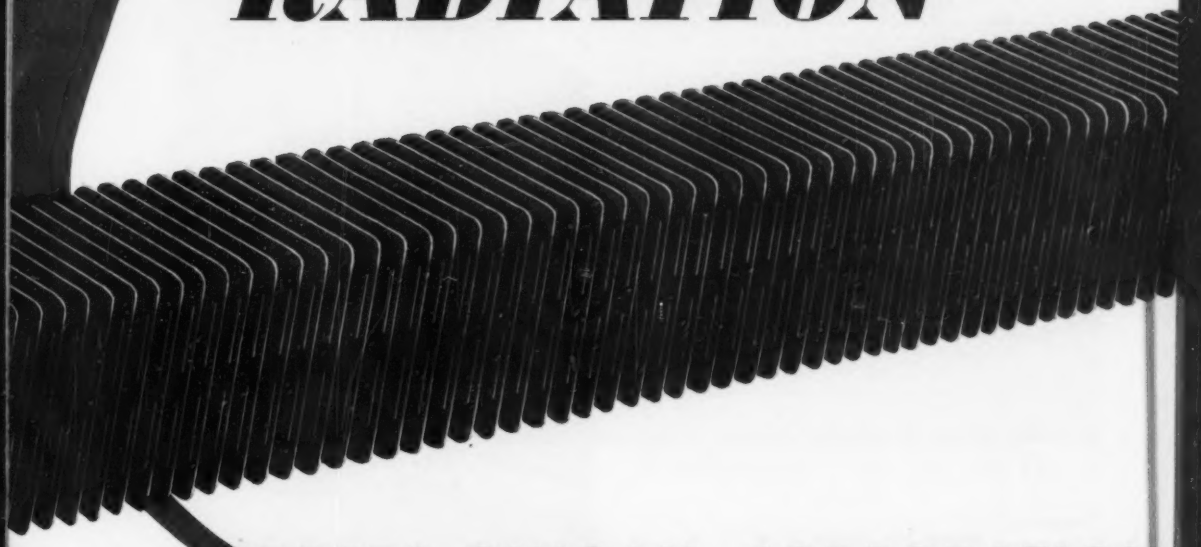

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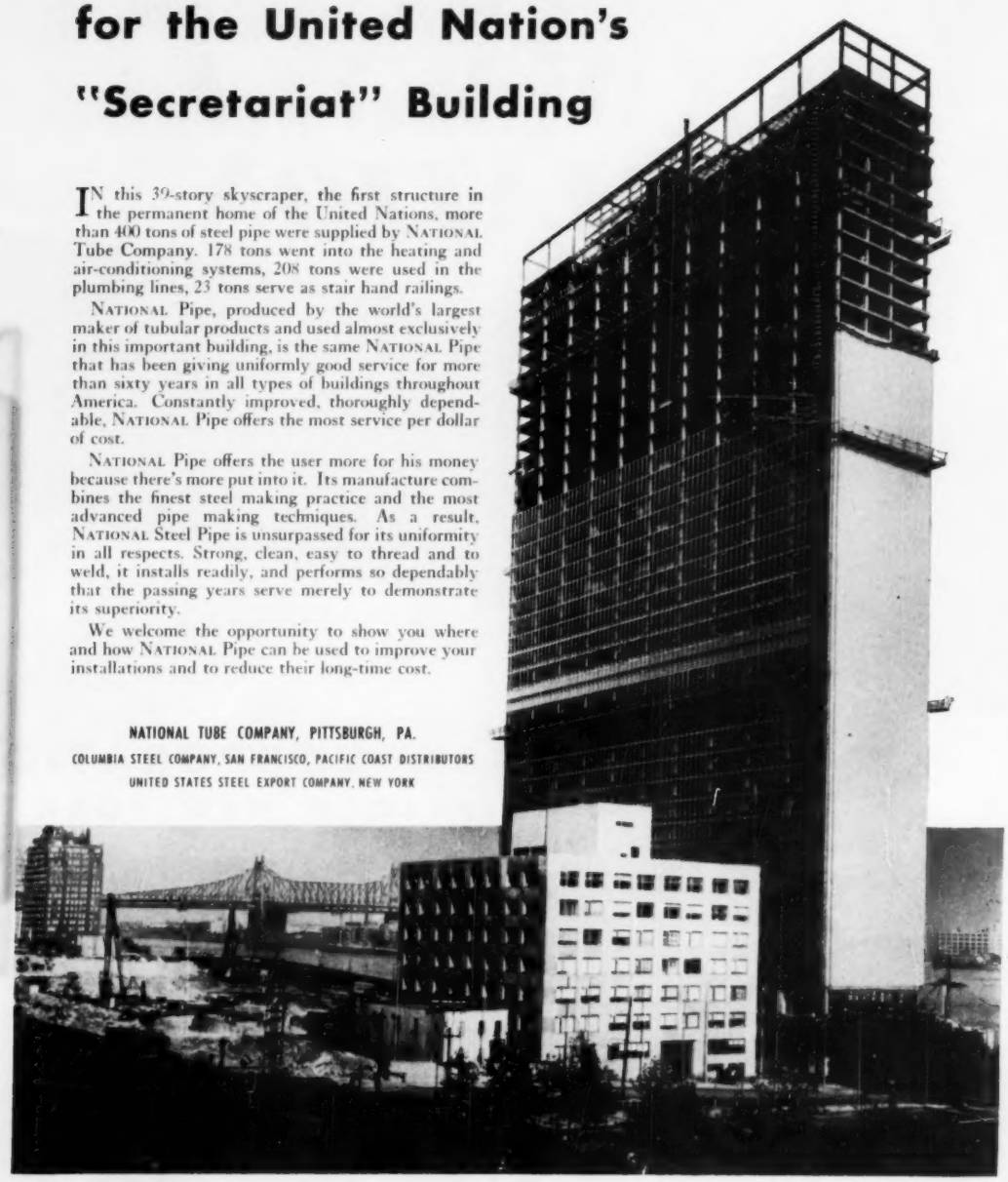

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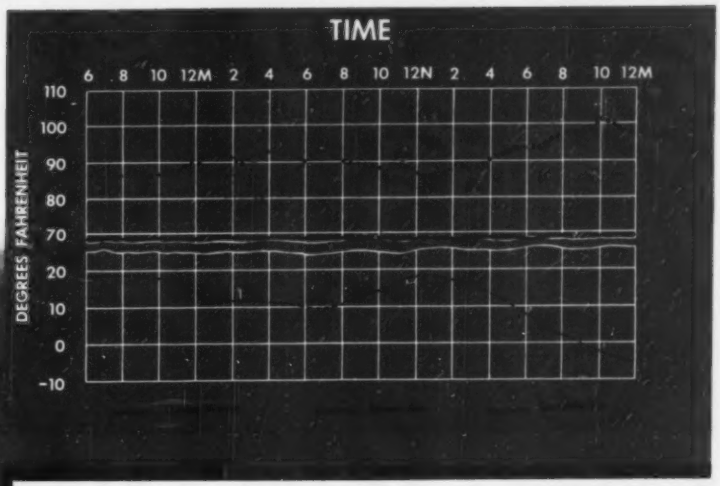

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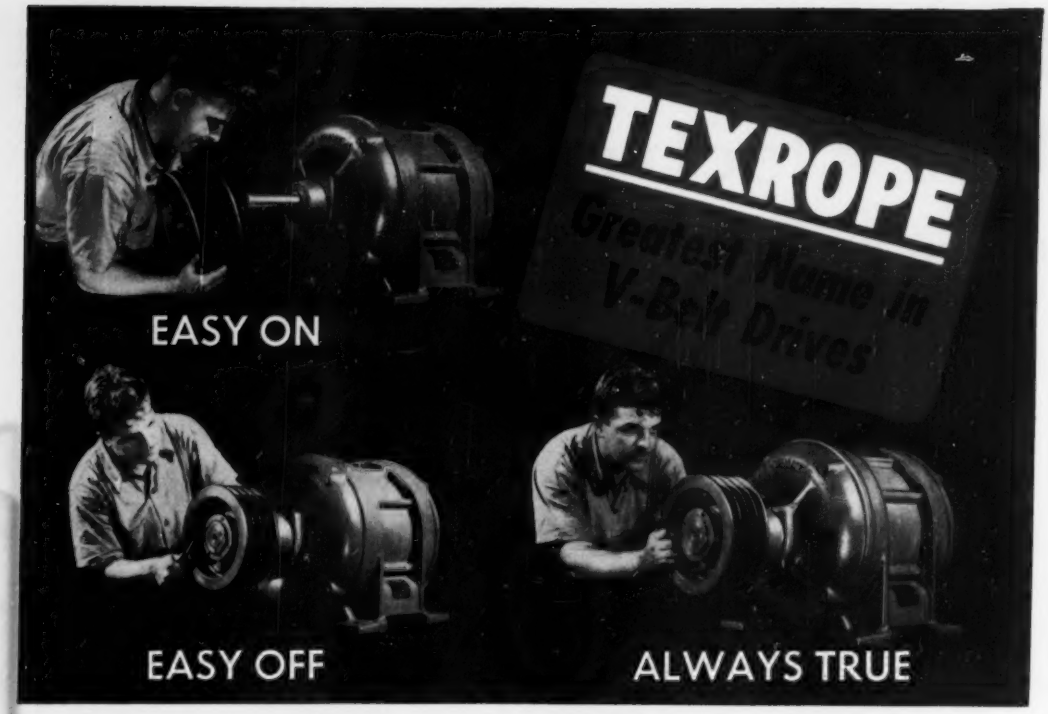

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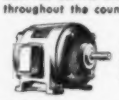

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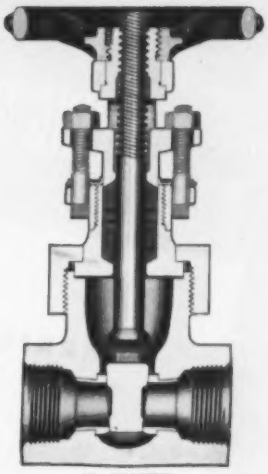

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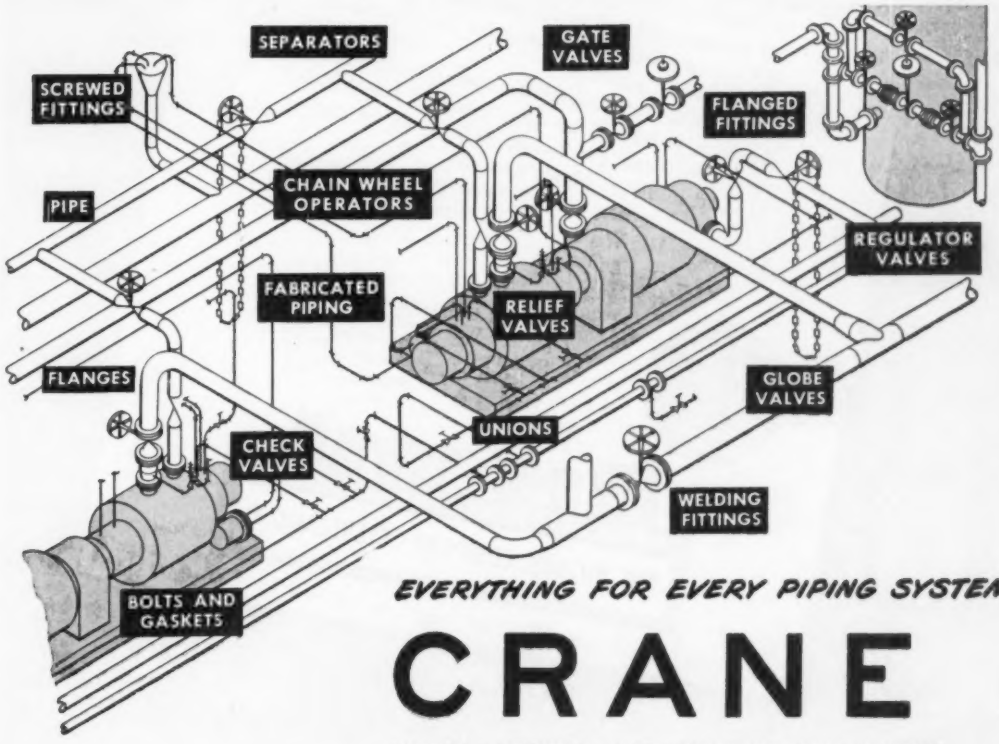

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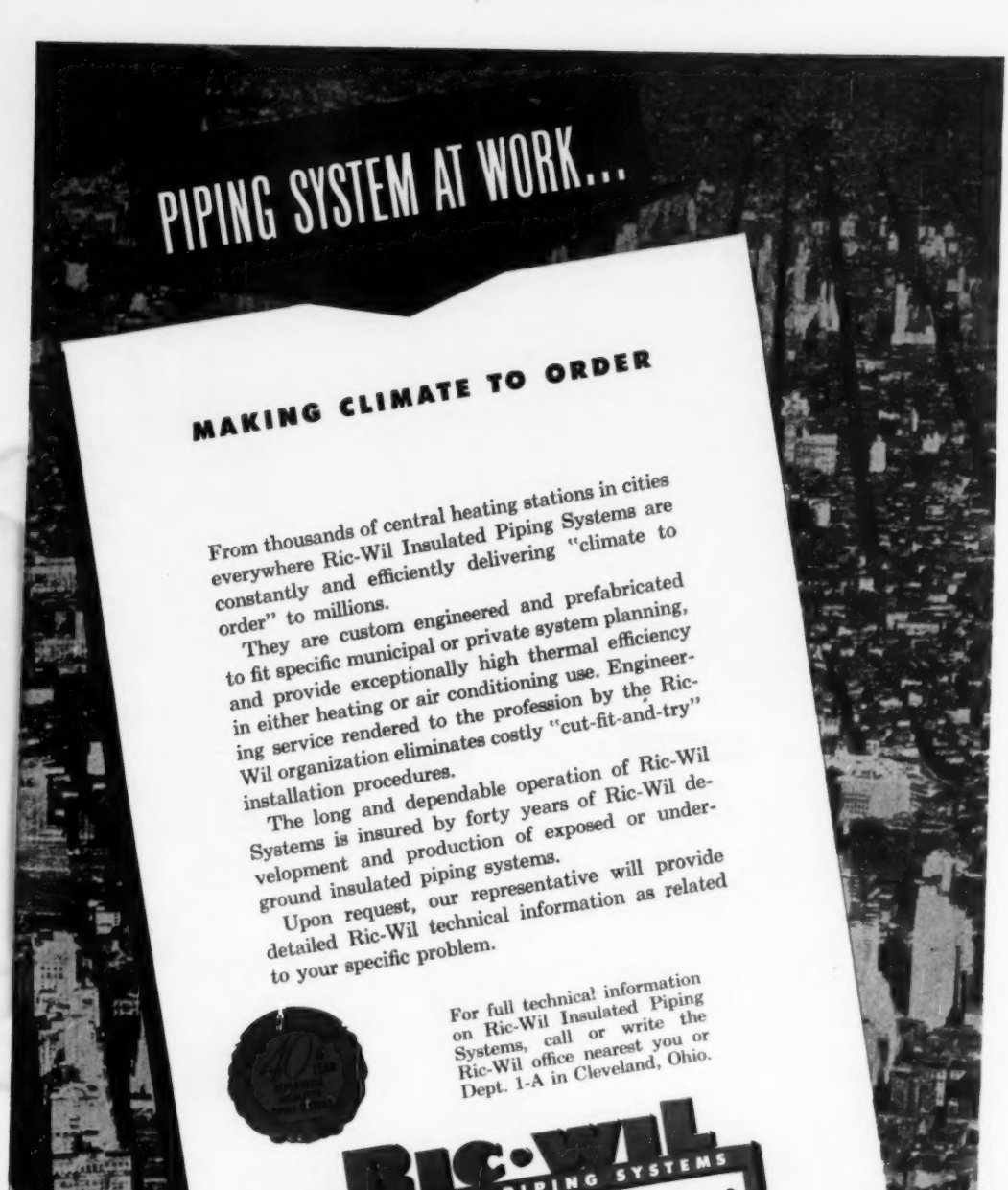
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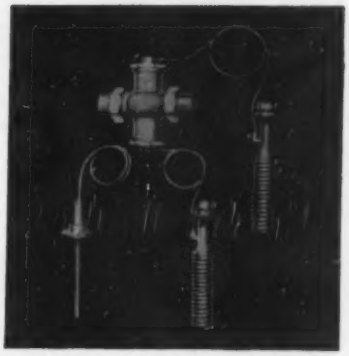

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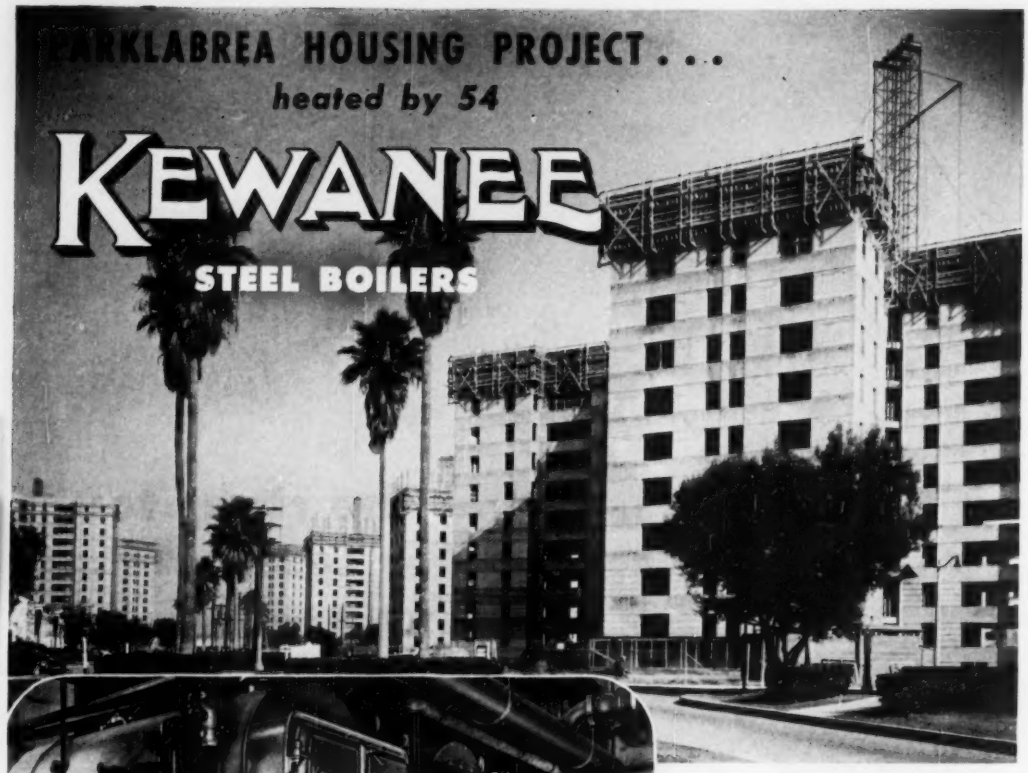
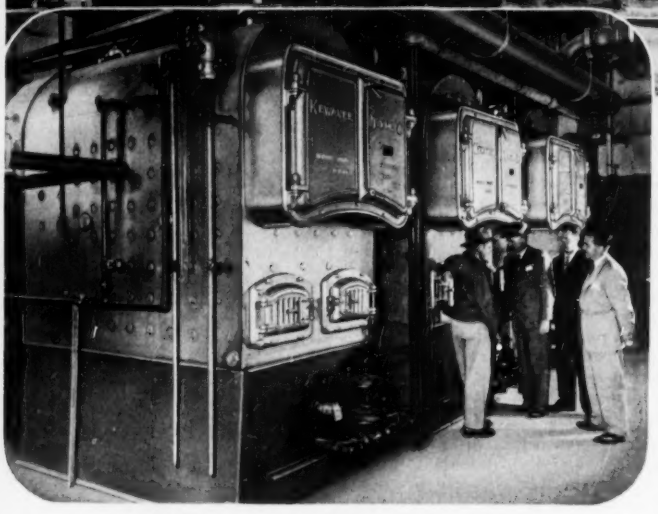




The Parklabrea Housing Project, Los Angeles
Leonard Schultze & Associates of New York City, Architect
Lester R. Kelly, Consulting Engineer
Scott-Hastorff-Nettles, Heating Contractor

The $40,000,000 Parklabrea Housing Project of the Metropolitan Life Insurance Company will, when completed, cover 176 acres and contain 4253 units to house 13,400 people . . . *the largest architectural concrete project in America.*

Each of its 18 boiler rooms will be equipped with 3 gas-fired Kewanee Type "C" boilers . . . *a total of 54 steel boilers,* each with a steam rating of 10,330 sq. ft. E.D.R. or 2,479,000 Btu. The design provides for quick, economical conversion to oil firing.

KEWANEE BOILER CORPORATION

BOILERMAKERS 80 YEARS KEWANEE, ILLINOIS

Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

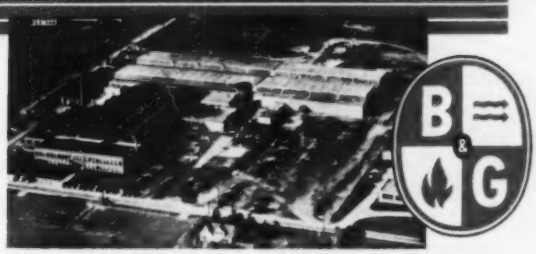
Check these { PUMPS / CONDENSERS / EVAPORATORS } *before you buy again!*

Two facts will hit you when you examine the line of B & G Refrigeration Pumps, Condensers and Evaporators.

First, you'll be impressed with fundamentally sound design, developed through a quarter century's experience in making fine heat transfer equipment. Second, that the facilities of a great modern factory have successfully translated good design into products of outstanding workmanship.

In every respect, here is refrigeration equipment with all the features necessary to top performance and long service life.

Send today for descriptive literature and engineering data . . . so that you can make a critical check of the advantages of B & G *Hydro-Flo* Refrigeration Products . . . *see for yourself why they are known everywhere for quality!*



You are cordially invited to visit the B & G plant.

Hydro-Flo®
REFRIGERATION EQUIPMENT

BELL & GOSSETT COMPANY
Dept. RBK-5, Morton Grove, Ill.
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Dr., Toronto 13

®Reg. U. S. Pat.

OIC

PACE SETTER IN VALVES

Engineered FOR LASTING SERVICE

200 LB. UNION BONNET BRONZE GATE VALVE

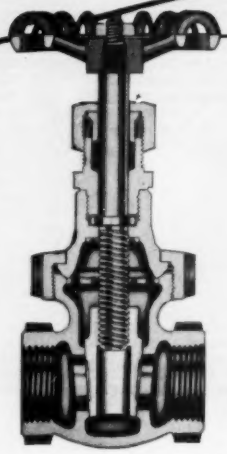
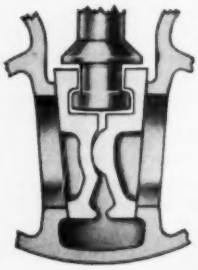


FIGURE NO. 7208 Non-rising stem, integral seat, OIC nickel alloy solid wedge, screwed end type.

FIGURE NO. 7200 Rising stem, integral seat, OIC nickel alloy solid wedge, screwed end type.



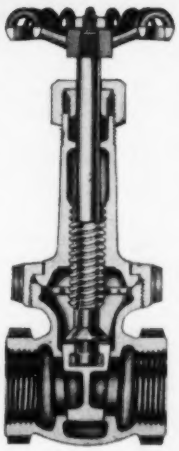


FIGURE NO. 7202 OIC Nickel Alloy double taper wedge automatically adjusts itself to its seat as valve is closed.

DESIGN: Solid wedge, rising stem; double-tapered wedge, rising stem; or solid wedge, non-rising stem. Integral seat, screwed end design.

BODIES: Of Steam Bronze ASTM B61, with average tensile strength of 40,000 lbs.

BONNETS: Also of Steam Bronze, with seal on lower end which mates with corresponding surface on stem to allow valve to be packed while fully open and under pressure. Condensing chamber below the stuffing box to keep packing cooler on high-temperature lines.

GATES: Of two types.

SOLID WEDGES are OIC copper nickel alloy, are of I-beam design, and reversible.

DOUBLE-TAPERED WEDGES fit into same bodies, but have ball and socket design, allowing wedge automatically to adjust itself to seat as valve closes. Accurately machined guides on both types, and tapered seating surfaces to give full contact with body seats as the wedges wear.

STEMS: Of manganese bronze, with double Acme thread for quick traverse of the wedge. Diameters sufficient to bear torsional loads greater than strongest hand pressure and to withstand severe operating conditions.

SEATING SURFACES: Machined to five-degree, self locking angle.

HANDWHEELS: Of ventilated malleable iron, finished in black enamel.

RATINGS: For steam at 200 lbs., 550 degrees F.; for cold water, oil, or non-shock gas service at 400 lbs. Shell tested at 500 lbs. and seat tested at 400 lbs.

SIZES: One-fourth inch to three inches currently available.

Special **INTRODUCTORY OFFER**

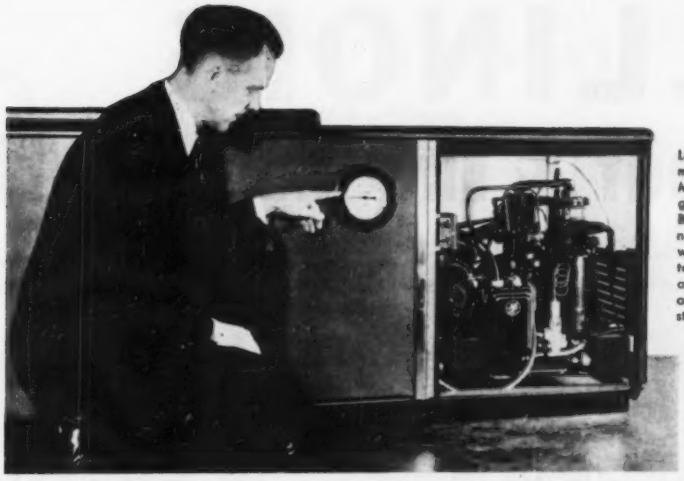
Check this 200-lb. Union Bonnet Bronze valve. Send us the size, and we'll deliver you a sample on memo billing. Keep it 30 days, take it apart, analyze it, test it. After you've examined all its superiorities, you may return it, if you wish, for full credit.

0-1149-83

OIC VALVES

THE OHIO INJECTOR CO.
243 Main St. Wadsworth, Ohio

BRONZE • CAST STEEL • FORGED STEEL • IRON



Low temperature cabinet, manufactured by the J. R. Miller Corp., Detroit, Michigan, uses a reliable Allen-Bradley Bulletin 709 solenoid starter. Generous wiring space, accessible terminals, white interiors, and many conduit knockouts make Allen-Bradley starters easy to install.

MILLER

AIR-CONDITIONERS

equipped with

A-B Quality

Trouble-Free Motor Controls

Bulletin 709, Size 1 Solenoid Starter. Compact, simple, and trouble-free. Ample wiring space.

WHY ARE ALLEN-BRADLEY STARTERS SO POPULAR for air-conditioning service? . . . Because they are trouble-free. Only one moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

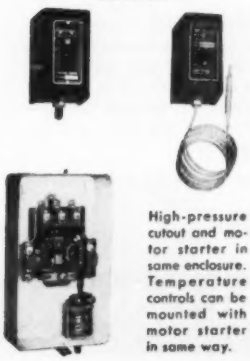
NO CONTACT MAINTENANCE. Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

DEPENDABLE OVERLOAD RELAYS. Allen-Bradley thermal relays are accurate and dependable even after long service.

The A-B trademark stands for millions of trouble-free operations.
Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wisconsin.

ALLEN-BRADLEY AIR-CONDITIONING AND REFRIGERATION CONTROLS

PRESSURE AND TEMPERATURE CONTROLS



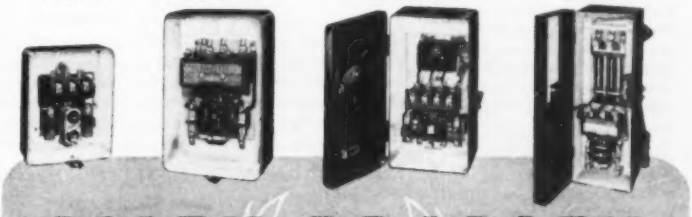
High-pressure cutout and motor starter in same enclosure. Temperature controls can be mounted with motor starter in same way.

MANUAL STARTER

AUTOMATIC STARTER

COMBINATION STARTER

HEAVY COMPRESSION STARTER



ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

ILLINOIS
Float & Thermostatic TRAPS

Assure *lower* return line temperatures

They're different!

–in construction

–in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

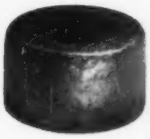
TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

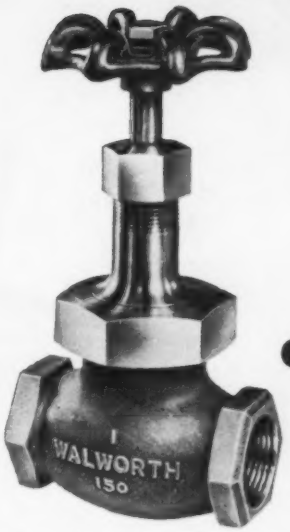
Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.

WALWORTH



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH
valves and fittings

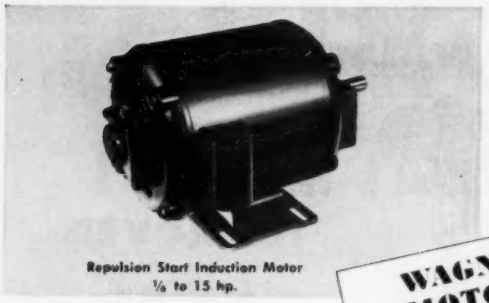
60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

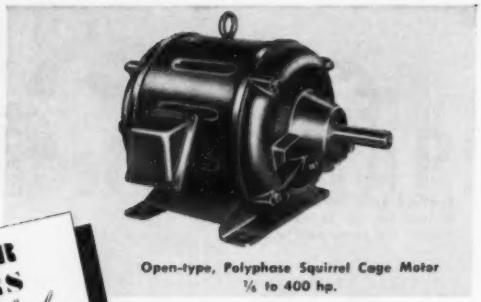
New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

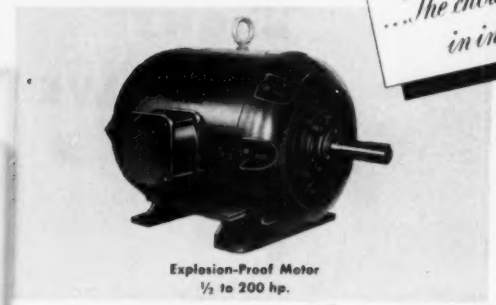


Repulsion Start Induction Motor
⅛ to 15 hp.



Open-type, Polyphase Squirrel Cage Motor
⅛ to 400 hp.

WAGNER MOTORS
...The choice of leaders in industry



Explosion-Proof Motor
½ to 200 hp.

Totally-enclosed, Fan Cooled Motor
1½ to 200 hp.

When You *Standardize* on Wagner Motors . . . You Standardize on *Quality!*

Give an added selling point to your product by standardizing on Wagner Motors. Their high quality and steadfast dependability have made them the first choice of many manufacturers and industrial plants. If you need motors that will give troublefree service and build customer satisfaction choose Wagner Motors.

Regardless of what your motor requirements may be, Wagner can furnish a standard motor to fit your needs. Twenty-nine branch offices, located in principal cities, are ready to help you. Write for Bulletin MU-185 for information on the complete line of Wagner Motors.

You'll Save Time, Money, Worry, Because:

- Wagner Motors are immediately available from Wagner Branches in principal cities.
- Improved engineering features assure long life and efficient operation.
- Wagner Motors are backed by a liberal warranty.
- They are available in a wide range of types and sizes for every application.
- More than 450 Wagner Authorized Service Stations and Parts Distributors *plus* 25 Wagner-owned Service Branches provide on-the-spot service, genuine repair parts, or service exchange motors.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

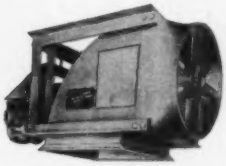
BRANCHES IN 29 PRINCIPAL CITIES

M50-5

WING VENTILATING EQUIPMENT

WINGFOIL SAFETY VENTILATING FAN

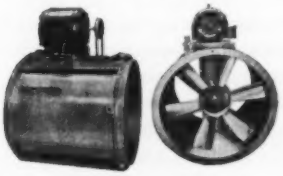
Distinguished for efficiency and rugged construction. The new Wingfoil fan wheel moves maximum volumes of air with minimum horsepower, due largely to its non-overloading feature. Sizes from 10" to 60" dia., with free air capacities from 825 to 59,000 CFM. Larger sizes on special order. Either direct or belt drive. Heavy steel guards provide safety.



WINGFOIL DUCT FAN

(Elbow Type)

Designed to form an elbow in the duct system, the elbow-shaped housing in a strong rectangular frame permits installation with the inlet in any desired position. Motor and drive are outside the air stream, therefore remain cool, clean, and easily accessible. The new Wingfoil Fan has a remarkable "non-overloading" characteristic. Sizes 10" to 60"; capacities up to 85,000 CFM.



WINGFOIL DUCT FAN

(Straight Line Type)

Designed to form a part of any straight run of duct. The motor is mounted on an adjustable base outside of the housing. V-belt drive is through an air tube carried across the housing and supporting fan shaft and bearings. Fan wheel is the new non-overloading Wingfoil Fan. Bearings are grease-sealed, requiring minimum of attention.

WRITE FOR BULLETINS

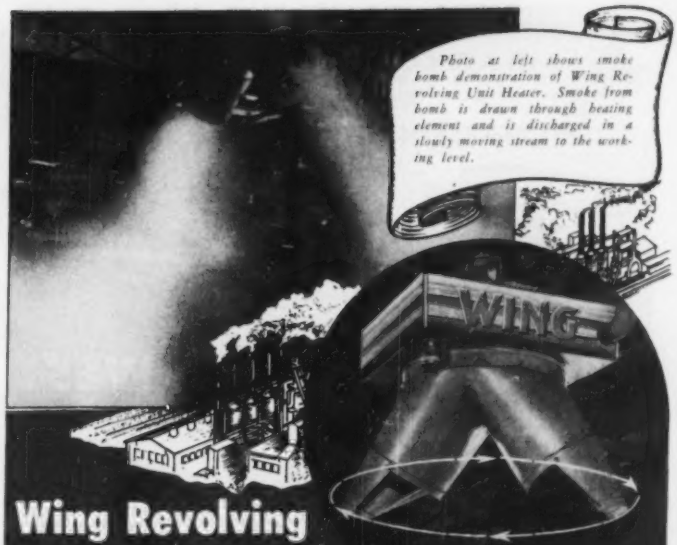


Photo at left shows smoke bomb demonstration of Wing Revolving Unit Heater. Smoke from bomb is drawn through heating element and is discharged in a slowly moving stream to the working level.

Wing Revolving Heaters Eliminate "Sweating" of Metals in Storage

Improper circulation of heated air, producing uneven temperatures is a primary cause of corrosion-producing "sweat" formed on metal products in storage. Taking a toll of thousands of dollars worth of materials and finished products annually, this "sweating" condition can be corrected only by heated air which is circulated to every inch of the exposed metal with a uniform flow of heat.

Wing Revolving Heaters, their discharge outlets moving slowly through a complete circle, project properly heated air over, around and under obstructions, insuring uniform heating over the entire storage area. Every piece of exposed metal is kept at constant temperature and thus "sweating" is completely eliminated.

If you store metals susceptible to corrosion it will pay you to investigate the protection offered by Wing Revolving Heaters. Write today for Bulletin HR-5.

L. J. Wing Mfg. Co.

Executive Offices and Factory: 140 Vreeland Mills Road, LINDEN, N. J.

Canadian Factory: Montreal, Canada

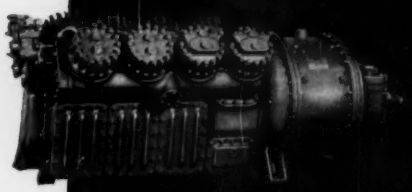
Manufacturing Licensee for Wing Unit Heaters in Western Europe— ETABLISSEMENTS WANSON— 9, rue Mogador, Paris 9e, France Nouveau Boulevard de la Woluwe, Haren-Nord, Brussels, Belgium.

Wing

Revolving UNIT HEATERS

IN AIR CONDITIONING
it's the
COMPRESSOR THAT COUNTS

AND ONLY WESTINGHOUSE CAN GIVE YOU HERMETICALLY-SEALED COMPRESSORS UP TO 100 hp. ...17 YEARS EXPERIENCE



In 1933, Westinghouse pioneered the hermetically-sealed compressor design for air conditioning. In one step, it eliminated belts, pulleys and shaft seal refrigerant leaks — and reduced size, weight and vibration.

17 years of successful installations have proved the soundness of this principle.

When you consider air conditioning — any application from a self-contained unit to a complete system—choose Westinghouse because its heart is a compressor hermetically sealed in steel. This is your greatest single guarantee—above any written guarantee—that Westinghouse Air Conditioning will give you the longest, most dependable, trouble-free service.

FIRST To Introduce
HERMETICALLY-SEALED COMPRESSORS IN AIR CONDITIONING

YOU CAN BE SURE...IF IT'S

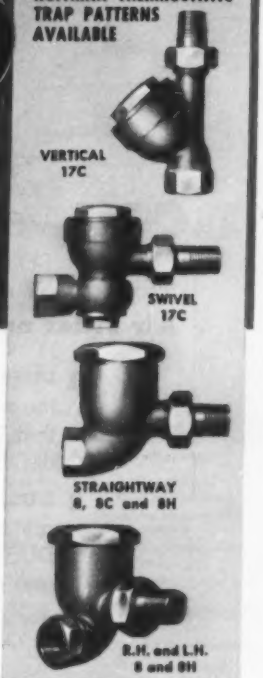
Westinghouse

J-80178

CHECK HERE for EVERY TRAP YOU NEED...
...from ONE COMPLETE LINE

- Steam Radiators
- Unit Heaters
- Pipe Coils
- Down-feed Risers
- Condensing Radiators
- Blast Coils
- Ends of Mains
- Cookers, Dryers
- Sterilizers
- Storage Water Heaters, etc.

HOFFMAN THERMOSTATIC TRAP PATTERNS AVAILABLE



Specifying Hoffman Traps for every spot on the Check List is good business for you. First, you are assured uniform operating efficiency; second, it saves your Buyer's time; third, it provides one uniform guarantee from a single, recognized source. And in addition, engineers are quick to appreciate the sound Hoffman features that cost no more than ordinary traps . . . and they *also buy* companion Hoffman products that assure economical, carefree operation throughout. There's a Hoffman Trap for every job on your books—in ⅜", ½" and ¾" size connections—capacities to 1250 lbs. condensate per hour—and patterns to suit piping requirements. Write for Bulletin No. 149 and specify Hoffman on that next modernizing job.

HOFFMAN Steam TRAPS

now, even the BEST is BETTER

Two great new features of the original, genuine DUST-STOP* Air Filter now put this leader even farther ahead of the field

1 **DUST-STOP Air Filters** now have *one-third longer life* with the same high efficiency as before—thanks to a new adhesive that spreads the dust more evenly throughout the entire depth of the filter.

2 **DUST-STOP Air Filters** are now listed by Underwriters' Laboratories, Inc. So look for the famous U. L. marker on DUST-STOPS. It means a definite contribution to fire-safety, and in some states even brings lower insurance rates.

For full details, contact your DUST-STOP Distributor, or write to Owens-Corning Fiberglas Corp., Dept. 40-C, Toledo 1, Ohio.

FIBERGLAS* IS IN YOUR LIFE...FOR GOOD!

DUST STOP* AIR FILTERS . . . a OWENS-CORNING FIBERGLAS product

*T. M. REG. U. S. PAT. OFF.

*FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers. DUST-STOP is the trade-mark of Owens-Corning Fiberglas Corporation for impingement type air filters made of glass fibers.

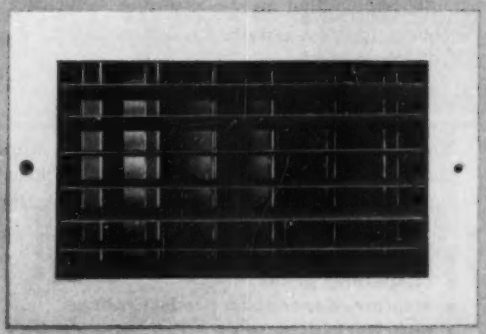
New

AMAZING ONE UNIT

COMBINATION GRILLE and VOLUME CONTROLLER

PURCHASE COST 30% LOWER

INSTALLATION COST 50% LESS



SOLID SECTION AIRFOIL LOUVER

STREAMLINED, SMOOTH-AS-GLASS SOLID-SECTION AIRFOIL LOUVER knifes the air in wind tunnel tests. Turbulence has been completely eliminated. The AIRFOIL's clean lines give noiseless control of air at all times.

DOUBLY FLEXIBLE TWIN BACK LOUVERS

More flexibility . . . greater and easier air control . . . faster, surer adjustments are certain.

Air Foil

AIR CONDITIONING OUTLETS

Titus steps ahead with the new advance design, compact AF-325 handling both *air volume* and *air distribution*. Designed for installation on exposed duct work in space to be conditioned. Just one unit handles the volume and disburses the air 4 ways. The AF-325 costs less—installs easier.

ONE COMPLETE UNIT CONTROLS AIR VOLUME AND DISTRIBUTION

The AF-325 design is simple. An *AIRFOIL volume controller* and *AIRFOIL grille* have been combined. Split rear louvers—all individually adjustable, control volume.

The front set of AIRFOIL louvers control the air distribution handling with perfection the job of draft-free distribution.

ONE UNIT TO PURCHASE

Exclusive AIRFOIL design holds cost at a minimum 30% LESS THAN THE COMBINED COSTS OF A VOLUME CONTROLLER AND GRILLE.

ONE UNIT TO HANDLE AND INSTALL

Workmen save valuable time in handling one compact unit. One trip up the ladder carries the whole unit and installs it. System can be adjusted in one-tenth the normal time.

The AF-325 has a 1-piece frame, no mullions, a heavy gasket that seals tightly to duct, light but extremely strong construction.

THE *Airfoil* LINE IS COMPLETE

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles
- ☐ Return air registers
- ☐ Volume controllers
- ☐ Ceiling outlets
- ☐ Perforated metal grilles
- ☐ Ornamental grilles
- ☐ Door ventilators
- ☐ Marine diffusers
- ☐ Industrial air distributors
- ☐ Floor registers
- ☐ Automatic back-pressure dampers
- ☐ Grilles for room air conditioners
- ☐ Special made-to-order grilles
- ☐ Installation frames and accessories
- ☐ High velocity factory outlets
- ☐ Toilet exhaust registers
- ☐ Plain lattice grilles
- ☐ Grilles for convector radiators

TITUS MANUFACTURING CORP.
Waterloo, Iowa

. . . . Please rush me complete information including prices, discounts, and delivery on the amazing, new AIRFOIL Air Conditioning Outlets.

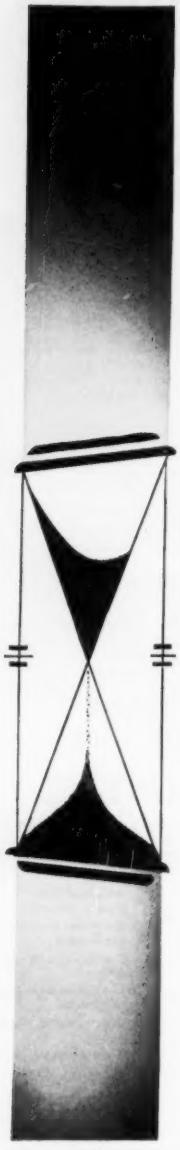
. . . . Please rush me new complete catalog page illustrating AF-325 so that I can add this page to my present Airfoil catalog.

Name . . . . . .

Address . . . . . .

City . . . . . State . . . . . .

How You Can Save Time on Air Conditioning Jobs!



It takes no more than a telephone call to your nearest York District office to bring a York-trained air conditioning and refrigeration engineer to your deskside. He's an *experienced* engineer, fully qualified to help slash hours of drudgery from your preliminary planning, cost and analysis work, and installation chores. His technical assistance is "guaranteed" by data files covering thousands of successful York-equipped installations in every type of business and industry. He can tell you, too, about York's Certified Maintenance Plan . . . a unique service that assures continuous efficiency, relieves you of time-consuming post-installation responsibility.

"See Your Architect, Engineer, Contractor, First"

York believes in channeling contract work through you . . . and York gives you unequaled support in providing the finest central station systems possible . . .

- **a complete line of equipment**
- **competitive prices**
- **accurate, dependable product ratings**
- **technical assistance based on "case histories"**
- **cooperation with architects, engineers, and contractors**
- **practical help from York-trained engineers**
- **a national organization**
- **continuous product research and development**
- **certified maintenance**

York offers a complete line of air conditioning and refrigeration products backed by seventy-five years of fruitful research and acknowledged public acceptance. Each York product is designed to be—*and has proved to be*—a cost-cutter and service-improver wherever installed. A promise from the past, for the present and future, of better, more efficient service for your clients. If you have any air conditioning or refrigeration work *on the board*, call your nearest York District Office. See how the York-trained engineer can help fractionalize detail work. See how profitably his wide-range technical experience dovetails with your requirements for any type of installation. No obligation, of course. York Corporation, York, Penn.

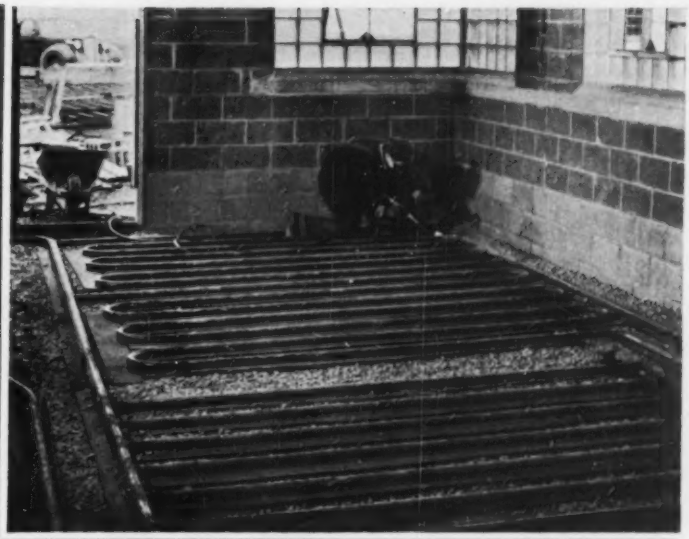
York refrigeration air conditioning

PIONEERS IN INVENTION AND DEVELOPMENT SINCE 1874

Refrigeration and Air Conditioning

OUR BUSINESS IS IMPROVING YOUR BUSINESS

CALL YOUR SPANG CW DISTRIBUTOR WHEN YOU WANT...



A Million Dollars Worth of Satisfaction

The fine performance of Spang CW Pipe has made it a favorite in closed, hot water heating systems for more than 60 years. It's no wonder then that it has been equally accepted for its modern contemporary . . . radiant heating, which has become so popular in homes, commercial and industrial buildings.

What's more, Spang CW Pipe has some very desirable qualities that make it particularly suitable for radiant heating applications. It's easy to weld, cut and bend. Spang CW also has plenty of strength to resist crushing and other mechanical injuries. And it has practically the same co-efficient of expansion and contraction as concrete and plaster. Add to these the advantages of low cost and long life, and you have a highly desirable piping material that will deliver a million dollars worth of satisfaction.

Next time you need pipe, fixtures, fittings, valves or any other piping materials, call your Spang CW Distributor. You'll like him and all the products he has for sale.

SPANG-CHALFANT

Division of The National Supply Company

EXECUTIVE OFFICES: PITTSBURGH, PA.

District Sales Offices: Atlanta; Boston; Chicago; Detroit; Houston; Los Angeles; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco

SPANG CW

QUALITY *that is recognized wherever pipe is used*

In apartment houses, B & G Hydro-Flo Heating remedies the lack of proper heat control. Apartments can be zoned for individual temperature control.

NO JOB TOO BIG OR TOO SMALL FOR B & G *Hydro-Flo* HEATING

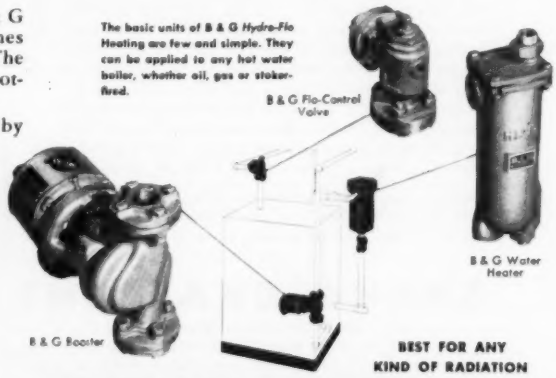
Adding up all the advantages of B & G *Hydro-Flo* Heating results in an impressive total—reveals why it is today's fastest growing type of system. Mechanically circulated water is the ideal heating medium and B & G *Hydro-Flo* Equipment supports its fundamental superiority with top operating efficiency.

No matter how large the installation, B & G *Hydro-Flo* Heating equipment never becomes complex nor requires critical adjustment. The basic units are the same, whether heating a cottage, apartment or industrial building.

The close control of temperature afforded by B & G *Hydro-Flo* Heating leads to two great benefits. First, *comfort!* Always the same uniform temperature—regardless of how rapidly or sharply the weather changes. Second, *fuel economy!* Since the heat supply is matched to outdoor temperature, fuel is never burned needlessly.

No over-heating—no under-heating—no fuel waste in this small home . . . it has B & G Hydro-Flo Heating.

The basic units of B & G *Hydro-Flo* Heating are few and simple. They can be applied to any hot water boiler, whether oil, gas or stoker-fired.



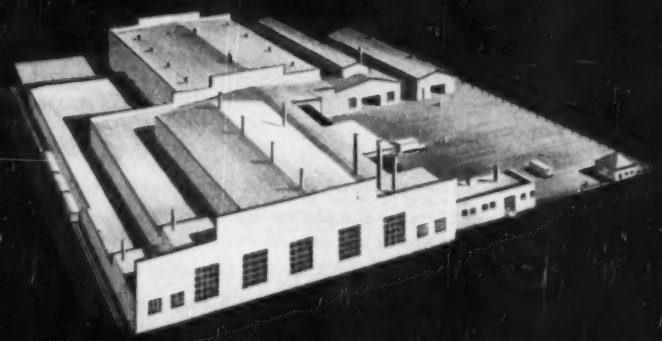
BEST FOR ANY KIND OF RADIATION

BELL & GOSSETT *Company*

Dept. BK-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 13

* Reg. U. S. Pat. Off.



We have the facilities to meet your every need

BRASS AND COPPER TUBING FOR ALL INDUSTRY

● A modern plant, equipped with the latest in tools and machinery, and manned by men and women as skilled and experienced as you'll find anywhere, is your assurance of quality brass and copper tubing as well as other fabricated parts. And what is more, these same facilities are always ready to produce and deliver the products you order as speedily as possible. Just try us. The next time your needs can't wait, write, wire or call H & H.

H & H TUBE AND MANUFACTURING COMPANY

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METALFLO · LOCKSEAM · COIL STRIP AND SEAMLESS TUBING · TUBULAR PARTS

HERE'S YOUR *Complete* STEAM PLANT

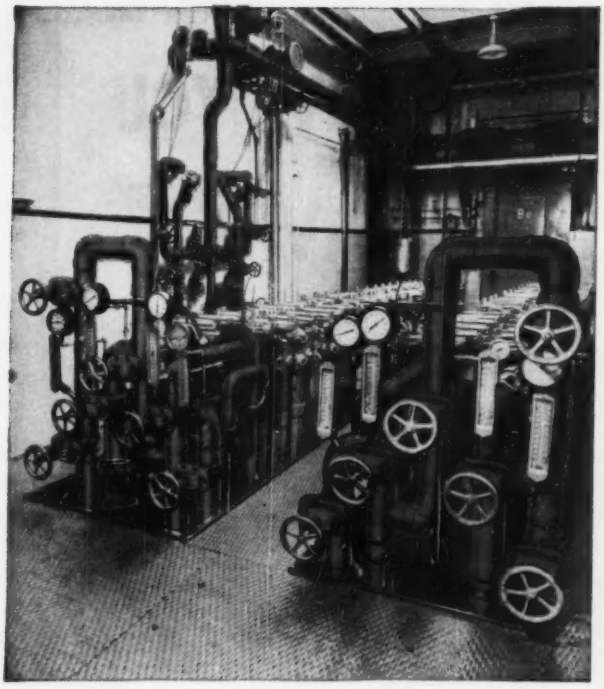
- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 17 sizes from 20 to 500 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 204.

Superior STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

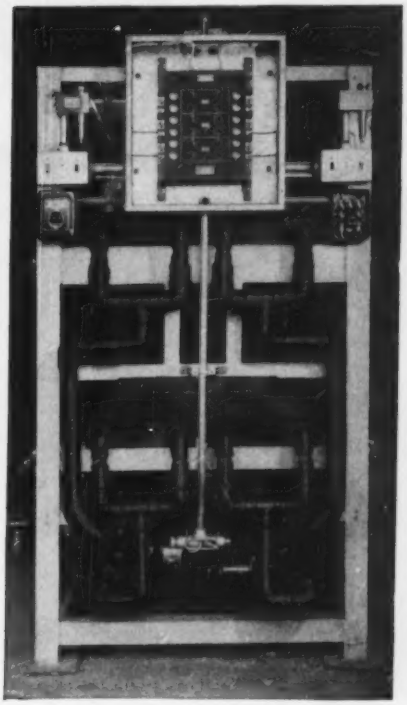
Factory: Emmaus, Pa.

Executive Offices: Times Building, Times Square, New York 18, N. Y.



(*Left*) Copper pipeline installation for wort coolers at the F. & M. Schaefer Brewing Co., Brooklyn, N. Y.

(*Below*) Pilot plant equipment in the laboratories of Chas. Pfizer & Co., Inc., Brooklyn, N. Y., manufacturers of fine chemicals and pharmaceuticals.



For Carrying Hot or Cold Water, Gases, Compressed Air, Refrigerants, Oils . . .

YOU SAVE WITH PIPELINES OF COPPER

YOU save three ways — on installation time, on maintenance and on long-term service. Copper tubes are speedily installed with solder-type fittings. Because soft-annealed copper tubes can be bent to clear obstructions, fewer fittings are needed in many types of installation. Joints can be made readily in cramped spaces. Easy to set up, copper tube pipelines are equally easy to dismantle.

Solder fittings give uniformity of bore to copper tube piping; flow is unimpeded at joints, and the rust-free surface of copper means a low coefficient of friction, with reduced pumping costs. The corrosion resistance of copper provides assurance against premature pipe replacement and excessive maintenance.

Whether you require capillary tubes of .025" I.D. or cold-drawn seamless tubes as large as 26" I.D., ANACONDA Copper Tubes offer basic advantages found in no other single piping material. Write for ANACONDA Publication C-24, containing detailed information on the industrial applications of ANACONDA Copper Tubes. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

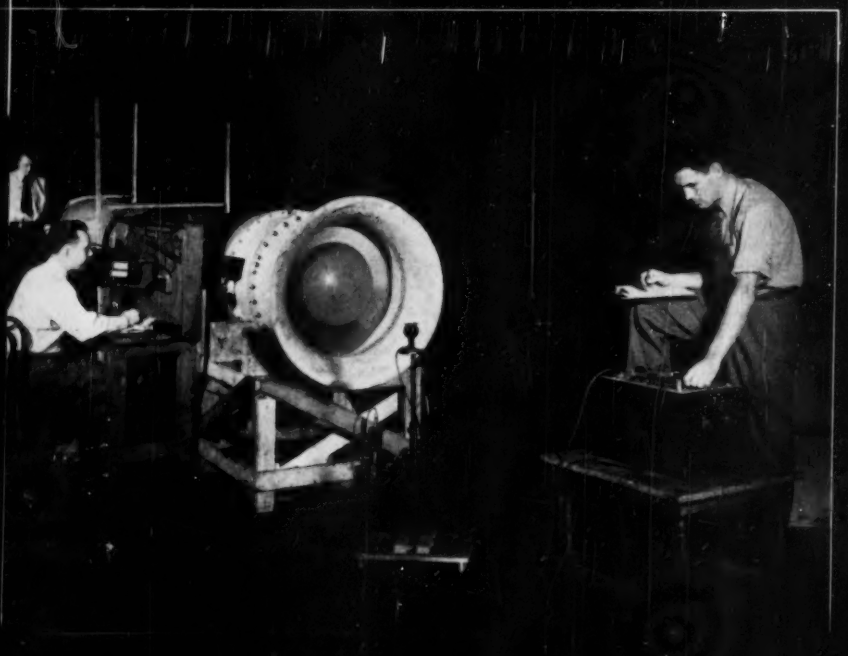
•

ANACONDA *Copper Tubes in commonly used types and sizes are stocked by wholesale distributors from coast to coast.*

4871 Rev.

For better Piping . . . use **ANACONDA COPPER TUBES**

FANATICS-TO GIVE YOU BETTER AIR SERVICE!



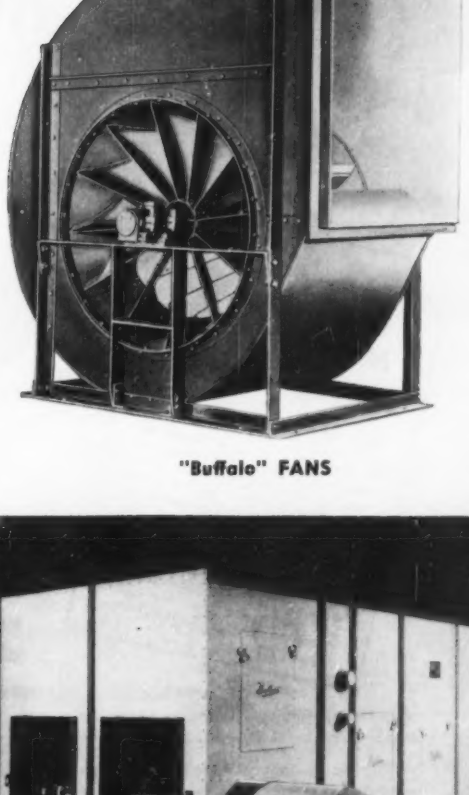
Above, the "Buffalo" Dust Control Laboratory

Left, the "Buffalo" Fan Test Room

THE ENGINEERING STAFF BEHIND EVERY "Buffalo" UNIT

● "Buffalo" Engineers literally eat, breathe and LIVE air, its applications and behavior! And from their laboratories in the "Buffalo" plant come daily developments that advance the performance and usefulness of fans and air conditioning units.

You benefit by this work when your business specifies a "Buffalo" Unit. You also benefit by the "Buffalo" Engineers in every principal city—for they are ready to work with your own Engineer on accurate selection of RIGHT equipment for the application. There's a "Buffalo" Engineer near you. Write for his name and address.



"Buffalo" FANS

"Buffalo" AIR CONDITIONING

BUFFALO FORGE COMPANY

177 MORTIMER STREET BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

IN ALL THE WORLD... NO WRENCH LIKE

ROXCO

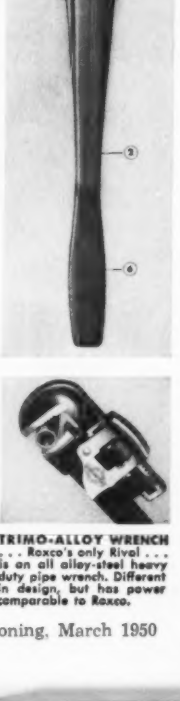
it's individually **REGISTERED** *completely* **GUARANTEED!**

Special MONEY-BACK TRIAL OFFER!

Buy *one* "Registered" Roxco and use it for your toughest jobs. If you don't agree it stands up better . . . is handier, faster to use . . . is a bigger value than any pipe wrench you've ever used . . . return *that one* trial Roxco direct to us (not the seller), within sixty days with a note of price paid and reason for returning. We will refund your money. This get-acquainted offer good until Dec. 31, 1950. Trimont Mfg. Co., Roxbury, Mass.

ENGINEERED BY STRESS ANALYSIS TO ASSURE HEAVY DUTY STRENGTH WITHOUT USELESS WEIGHT

See dark Hardened area



Now you need not accept useless, fatiguing weight in order to get a dependably strong wrench. Through stress analysis of every inch, the new Roxco was designed to put *extra* metal *where heavy stresses come.* And, to take out metal where it does *not* count.

The result is not only the handiest pipe wrench a man ever put to work, but also a wrench so strong that it exceeds, by a good margin, Federal Spec's for Heavy Duty Pipe Wrenches, Type II, GGG-W-651a.

So superior is this new wrench . . . so carefully quality-controlled . . . that every Roxco is individually *Registered* by number. And *every* part is *guaranteed* against breakage in any normal heavy duty use! The nine points below show why any wrench buyer and user will want the lighter, easier-to-work-with Roxco to boost efficiency . . . reduce tool costs. Order Roxco, now. Or send for folder and names of distributors.

1. Extra Strength Based on Stress Analysis: Extra metal at critical points provides higher resistance to failure. Protects work and worker. Withstands unusual stress in "side pull".

2. Lighter Weight Achieved: Stress analysis also showed where useless metal could be eliminated to produce a lighter, handier wrench.

3. Uniformity of Jaw Hardness and Strength: Both movable and insert jaws are of drop-forged alloy steel. Teeth are hardened by automatically-timed, localized induction process at wear points, yet the tough core of jaws is retained for strength.

4. Reinforcing Shoulder Behind Insert Jaw resists any unusual stress. Assures long, trouble-free service.

5. Rapid Ratcheting Action: New, simplified cushion action replaces complicated spring. With Roxco tooth design, it prevents seizure on pipe and permits fast ratcheting action — as fast as user can move his hand. Accurate fit of assembled parts eliminates lost motion — speeds jobs.

6. Comfort-Shaped, Palm-Fitting Handle: New wide handle design is more comfortable to use — makes work easier, cuts worker fatigue.

7. Reinforced Housing embodies a hammer face to break cast fittings.

8. Handy, Accurate Pipe Scale permits quick adjustment to desired size.

Special Metallurgical Formula: Roxco Metal, combined with scientific heat treating, means superior strength in housing and handle.

TRIMO-ALLOY WRENCH . . . Roxco's only Rival . . . is an all alloy-steel heavy duty pipe wrench. Different in design, but has power comparable to Roxco.

TRIMONT MANUFACTURING CO. Division of Aetna Industrial Corporation, 55 Amory Street, Roxbury 19, Mass. Makers of Wrenches, Pipe Cutters, Vises and Other Trimo Time-Tested Tools.

American Blower—a time-honored name in air handling

In Chicago, as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. For air handling data in the Chicago area, call American Blower — FINANCIAL 6-2531. In other areas, consult your phone book.

Look before you buy and you'll buy American Blower products. All air handling equipment is not alike. There's a big difference in quality, design, and quietness, as well as in operating costs and efficiency. The superiority of American Blower products has been proved in test after test by buyers.

Air is free . . . use it profitably!

BUSINESS EXECUTIVES with an eye to good Annual Reports know there's profit in efficient use of air.

As a result, they use the finest air handling equipment money can buy to remove disagreeable odors, fumes and gases . . . to control dust and fly ash . . . or to improve over-all working and selling conditions in their businesses. They profit by it.

Building better air handling equipment for America's commerce, industry and public utilities has been American Blower's business since 1881.

Over the years, American Blower engineers have acquired vast technical data and vital firsthand experience which has proved invaluable on thousands of applications involving heating, cooling, drying, ventilating, dust collecting, air conditioning and air handling.

If you would like to know how American Blower products can profitably be applied to your business, or how you as a contractor can profitably apply them to business and industry, phone the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

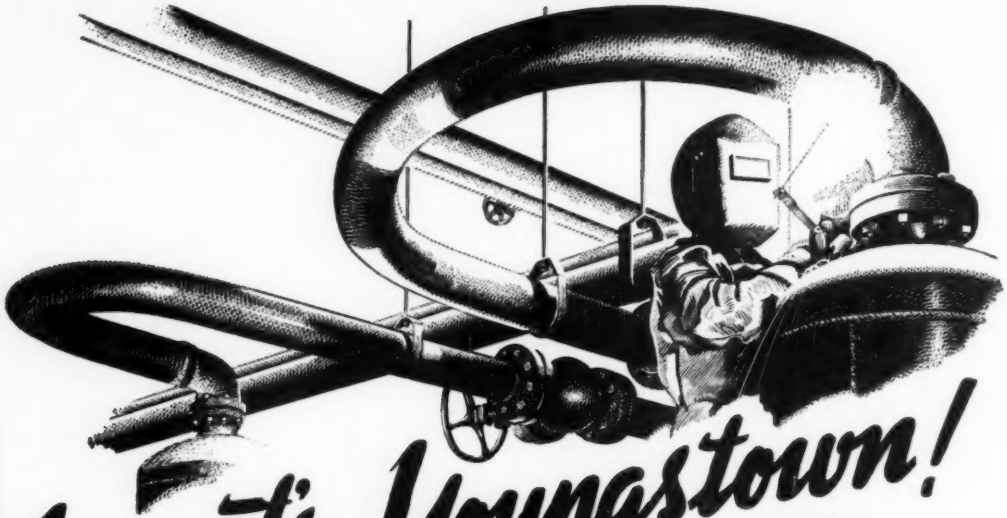
YOUR BEST BUY

AMERICAN BLOWER

AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



Yes, it's Youngstown!

Dependable Steel Pipe ...Easy to Install

THROUGH the years, the guiding principle at Youngstown has been to make quality steel pipe which is well suited to serve the needs of plumbing and heating contractors and their customers. That's why Youngstown Pipe bends accurately, cuts readily, threads surely, welds easily--properties designed into the product for efficient fabrication, installation and long, satisfactory service.

Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown 1, Ohio

Export Office 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS · CONDUIT · BARS · RODS · COLD FINISHED CARBON AND ALLOY BARS · SHEETS · PLATES · WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · RAILROAD TRACK SPIKES

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

HOW LONG

will the Life-Line bearing last?

As long as comparable periodically lubricated bearings—or longer!

BEARING MANUFACTURERS SAY: "Pre-lubricated bearings have the same life expectancy as periodically lubricated bearings *IF those periodically lubricated bearings are perfectly maintained.*" But how often is a bearing perfectly maintained? Not often enough! That's why Life-Line pre-lubricated bearings offer fewer motor outages due to lubrication faults.

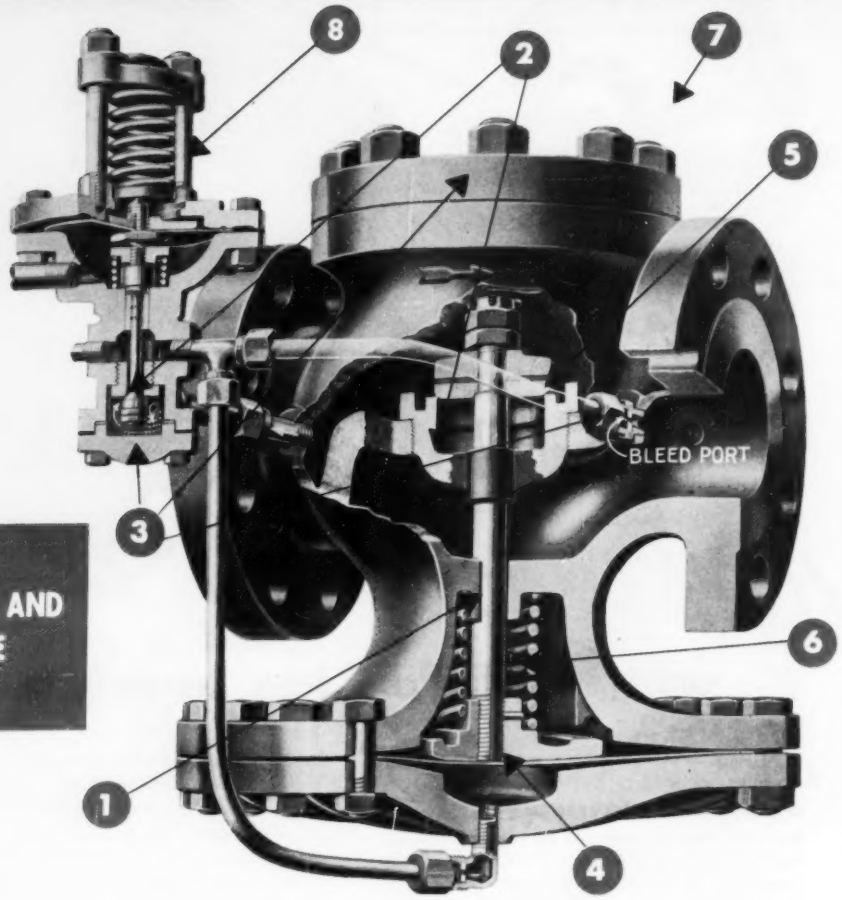
OPERATING RECORDS SAY: "41% fewer failures with Life-Line pre-lubricated bearings!" Life-Line motors placed in service throughout industry show a record of 41% fewer bearing failures than the best conventional motor (with conventional bearings) ever built by Westinghouse!

USERS SAY: "Life-Line bearings save me money." One motor user reports yearly lubrication costs of $3.06 per motor on ordinary motor bearings. An industry average indicates a yearly cost of $2.70 per motor a year. Multiply this by the hundreds of motors in your plant and you'll see why pre-lubricated Life-Line offers you an opportunity to cut life costs of motors. Life-Line needs no lubrication. You save this cost.

Get all the facts on Life-Line motors. See for yourself how much you can save. Ask your Westinghouse salesman for copies of "Facts on Pre-Lubricated Bearings," (B-4378) and "Motor Costs" (B-4321), or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-21585

THESE SPENCE FEATURES *Reduce*



A TYPICAL SPENCE PRESSURE AND TEMPERATURE REGULATOR

LESS DOWN-TIME of the system! Less time and money wasted on replacement of parts! Thousands of installations throughout the country have proved that Spence Self-Operated Regulators stay "on the line" . . . provide *dependable, trouble-free* pressure and temperature control. Users know these precision-engineered Spence units rarely need extensive repairs or special attention. Here are a few of the Spence design features that help keep *maintenance at a minimum:*

1 **PACKLESS CONSTRUCTION**—All Spence main valves and most pilots are built without stuffing boxes. This packless construction saves many maintenance man-hours because it eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 **EASY TO CLEAN**—The seat and disc of the main valve and pilot can be cleaned and any working part removed *without taking the main valve out of the line.*

3 **NO DISMANTLING FOR INSPECTION**—Special openings are provided to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Inspection is easier, too, because the pilot is not an integral part of the main valve. The pilot is protected by an accessible built-in strainer.

4 **LONG-LIFE METAL DIAPHRAGMS**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

SPENCE PRESSURE *and* TEMPERATURE

Maintenance...Cut Costs

BUILT TO LAST FOR YEARS!

That's the reason Spence Self-Operated Regulators lower over-all costs. Dollar for dollar, you can count on quality performance for a longer period of time. Look at three of many Spence features that assure long regulator life:

5 DURABLE SECO METAL SEATS AND DISCS—Spence seats and discs are made of durable SECO Metal which resists wiredrawing. *More than twenty years of experience* with SECO Metal in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

6 SPRING OUT OF PATH OF STEAM—The spring in the Spence Regulator is out of the path of high-pressure steam or other fluids flowing through the valve. Since the spring operates at low unit stress, it has exceptionally long life.

7 LESS FRICTION—All Spence Regulators are built with *packless* main valves which are actuated by large, balanced diaphragms. This design minimizes friction. Valves remain unaffected by changes in service conditions or length of service.

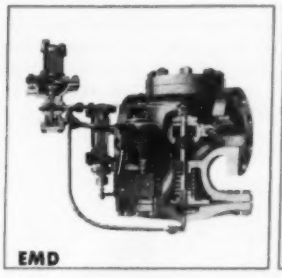
WHY SPENCE UNITS REGULATE ACCURATELY

8 YOU CAN BE SURE of accurate regulation because *sensitive* pressure or temperature pilots control the main valve of every Spence unit. This unique design enables the Spence Regulator to serve many functions and handle all the various types of fluids under a wide range of conditions.

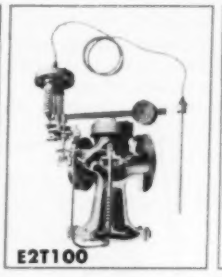
One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

WIDE RANGE OF SIZES

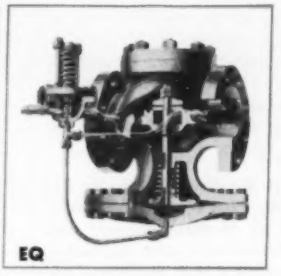
Spence Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* With minor adjustments, any Spence Regulator can be easily switched from one service to another.



EMD



E2T100



EQ

The Type EMD Pressure Regulator includes a SPENCE Solenoid Pilot to cut it on and off electrically • The Type E2T100 Temperature Regulator in effect is a pressure regulator which is constantly reset by small variations in temperature at the sensitive thermostat. • The Type EQ Back Pressure Regulator is a self-operated, packless unit which controls its own initial pressure. The general construction is the same as the Type ED Pressure Regulator.

FREE BULLETIN GIVES ALL THE FACTS

YOU WILL FIND complete engineering details and selection data on Spence Regulators in free bulletin No. 5000. It features a *full color, fully illustrated description of the operating cycle* of a Spence Regulator. Send for your copy of this valuable bulletin today.

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

PARTIAL LIST OF USERS

- The Cleveland-Cliffs Iron Company
- Tennessee Coal, Iron and Railroad Company
- The Springs Cotton Mills
- Ford Motor Company
- Cochrane Corporation
- Philadelphia Electric Company
- Pennsylvania Power & Light Company
- L. H. Gilmer Company Div. of United States Rubber Co.
- York Corporation
- Jones & Laughlin Steel Corporation
- The Duluth Steam Corporation
- Rochester Gas and Electric Corporation
- Consolidated Gas Electric Light and Power Company of Baltimore
- Phenix Natural Gas Company
- Cutter Laboratories
- National Tube Company
- The Atlantic Refining Company
- Great Lakes Steel Corporation
- Union Electric Company of Missouri
- Todd Shipyards Corporation
- Oxford Miami Paper Company
- Land O'Lakes Creameries, Inc.
- Ohio Edison Company
- General Electric Company
- R. J. Reynolds Tobacco Company

Spence

REGULATORS

Or Equal?

Specifications for Air Diffusers

There shall be installed at each point indicated on the drawing air outlets of the diffusion and air mixing type. These outlets are to consist of hollow flaring members placed within each other in such relationship that the discharged air is hemispherically diffused. This diffusion shall be effected without noticeable air motion at any point at or below the breathing level. The hollow members while diffusing the air shall simultaneously draw in from the enclosed area a volume of air not less than 35% of the specified discharge volume thus mixing room air with the primary air before the total volume is discharged and effecting substantial equalization of the room temperature and prevention of air pockets. The combined air diffuser and air mixer shall not add any noticeable noise to the sound level of the room when using specified velocities in the neck of the device.

All diffusers installed under this contract shall be Anemostat Draftless Aspirating Air Diffusers as manufactured by Anemostat Corporation of America (or equal.)

But There is NO

"OR EQUAL"

for

ANEMOSTAT

DRAFTLESS

Aspirating

AIR DIFFUSERS

THE PAY-OFF POINT in a heating, ventilating or air conditioning system is when air reaches the duct openings. If air is improperly distributed, the whole installation will be a waste of money and equipment. So don't take chances on half-way measures... don't specify "or equal" because *there is none for patented Anemostat Draftless Air Diffusers.*

Here's why. *Only* Anemostats are distinguished by the *exclusive* feature of aspiration. That's why Anemostats do *all* these jobs: distribute air in predetermined patterns, instantly equalize temperature and humidity, eliminate stale air pockets, permit a high number of air changes per hour with *complete freedom from drafts.*

The proof is obvious in every way . . . smoke test pictures, laboratory instrument readings and the actual performance of more than 1,000,000 Anemostats bringing new standards of draftless comfort to scores of industries.

ANEMOSTAT®

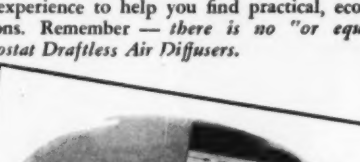
DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

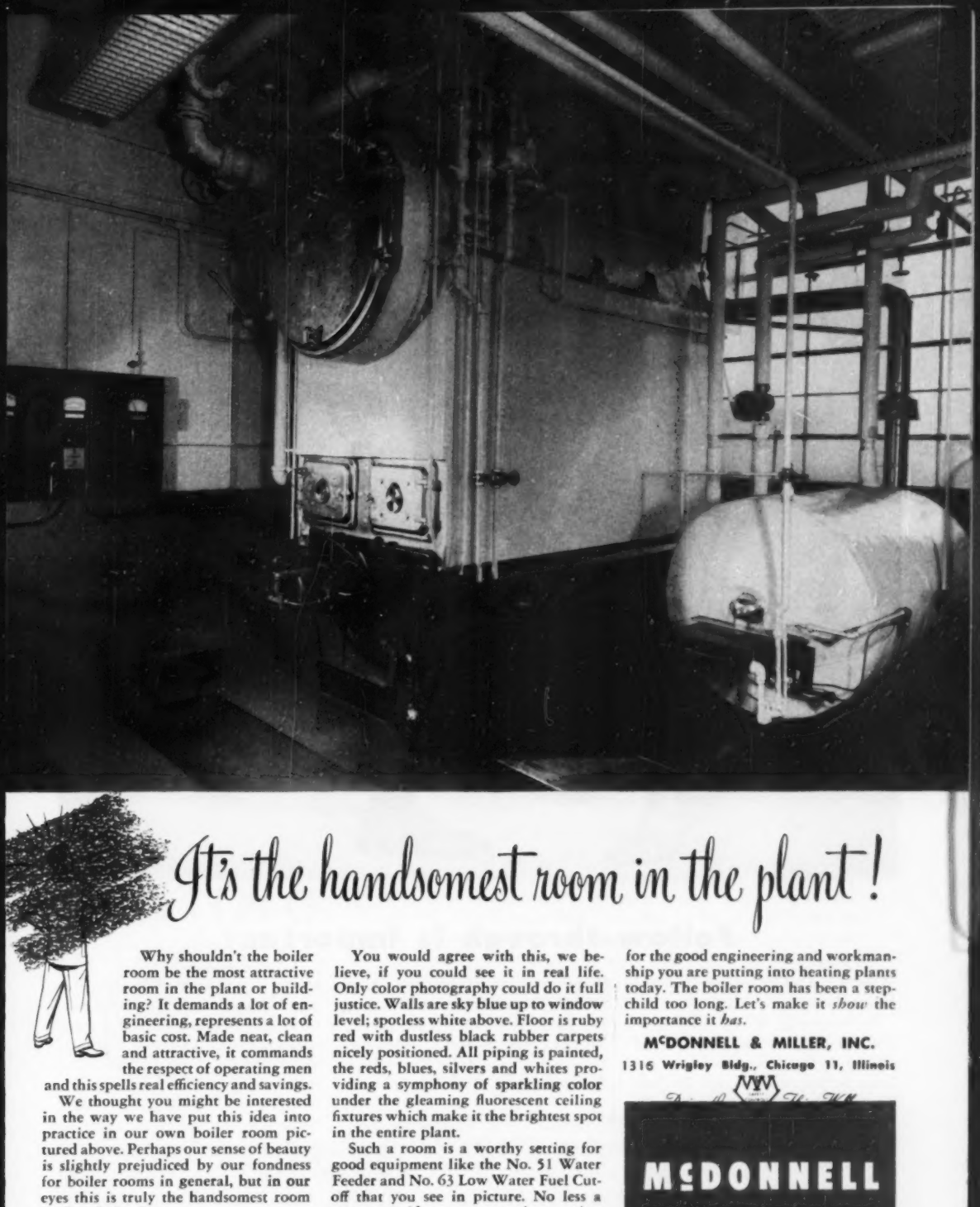
Whatever your air distribution problems in new or existing systems, Anemostat field engineers will draw on this wide experience to help you find practical, economical solutions. Remember — *there is no "or equal" for Anemostat Draftless Air Diffusers.*



Here, graphically presented, is the aspiration principle that makes the Anemostat Air Diffuser superior. Due to its patented design, the Anemostat distributes air of any duct velocity in a multiplicity of planes traveling in all directions. Simultaneously, the unit creates a series of counter-currents which siphon room-air into the device equal to about 35% of the supply-air. Room-air is mixed with supply-air *within* the Anemostat before the air-mixture is discharged into the room.

"NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION"

AD-1197



It's the handsomest room in the plant!

Why shouldn't the boiler room be the most attractive room in the plant or building? It demands a lot of engineering, represents a lot of basic cost. Made neat, clean and attractive, it commands the respect of operating men and this spells real efficiency and savings.

We thought you might be interested in the way we have put this idea into practice in our own boiler room pictured above. Perhaps our sense of beauty is slightly prejudiced by our fondness for boiler rooms in general, but in our eyes this is truly the handsomest room in the whole plant.

You would agree with this, we believe, if you could see it in real life. Only color photography could do it full justice. Walls are sky blue up to window level; spotless white above. Floor is ruby red with dustless black rubber carpets nicely positioned. All piping is painted, the reds, blues, silvers and whites providing a symphony of sparkling color under the gleaming fluorescent ceiling fixtures which make it the brightest spot in the entire plant.

Such a room is a worthy setting for good equipment like the No. 51 Water Feeder and No. 63 Low Water Fuel Cut-off that you see in picture. No less a room provides an appropriate setting for the good engineering and workmanship you are putting into heating plants today. The boiler room has been a step-child too long. Let's make it *show* the importance it *has*.

McDONNELL & MILLER, INC.

1316 Wrigley Bldg., Chicago 11, Illinois

McDONNELL

Boiler Water Le[illegible] Controls

Follow-through is important

WHAT sets a fighter back on his heels? Follow-through.

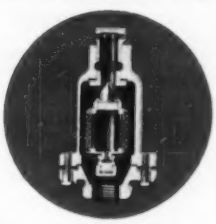
Follow-through is important in air conditioning, too. It's not just good equipment that has made Carrier the leader in air conditioning. The way Carrier follows through on every installation has had a lot to do with it.

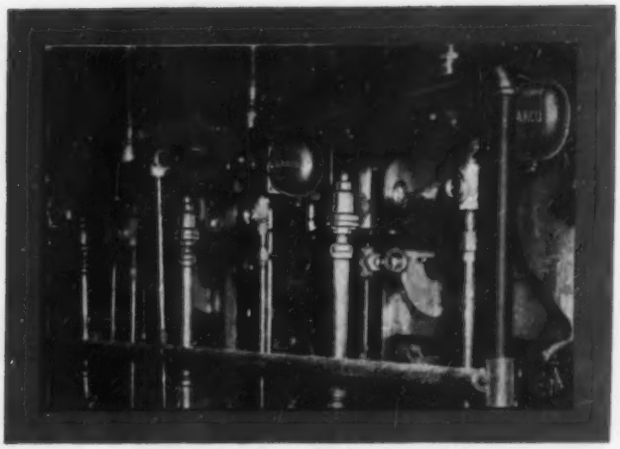
Almost every major city has its Carrier office. They are always ready to give you prompt assistance, from planning the installation to making sure that it gives your customer dependable, low-cost service. It's that kind of follow-through that has made the Carrier name synonymous with efficient, economical air conditioning.

Carrier offers the most complete selection of air conditioning equipment on the market. For multi-room installations there are the Weathermaster systems, which provide year-round individual control of each room. For other installations there are Carrier Weathermaker units, central air conditioners, as well as a complete line of refrigerating machines. The name "Carrier" stands for the finest engineering and the finest equipment money can buy. Carrier Corporation, Syracuse, New York.

Carrier AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

THE *Why* AND *How* OF AIR VENTING





Trapping and venting rotating cylinders of slasher in textile mill

Every steam man knows that air blocks steam lines, but too many executives do not realize what air in the lines and equipment is costing them, and how inexpensive the devices are that can remove it.

There are two vital reasons why air should be removed at the point where it collects.

First—an air steam mixture always has a lower temperature than pure steam at the same pressure. Steam temperature at 15 psi is 249°F, but mixing 50% of air would reduce this to 212°F, equivalent to 0 psi pressure.

Second; and more serious, the air collects on the heated surface and insulates it from the hot steam, reducing output.

THE SOLUTION

First, select the right steam trap. The Sarco No. 9 Thermostatic for instance is wide open when cold. It lets all the initial air out fast. Other Sarcos let air out too, but only at the point where they are installed.

So the next step is to put in Sarco Air Vents at suitable spots in the lines—at the farthest point from entry of steam in process equipment—and at many points in your heating lines.

This is a subject of renewed interest because Sarco has recently designed a complete line of vents and made available special technical data on the subject.

ASK FOR CATALOG No. 275

269

SARCO COMPANY, INC.

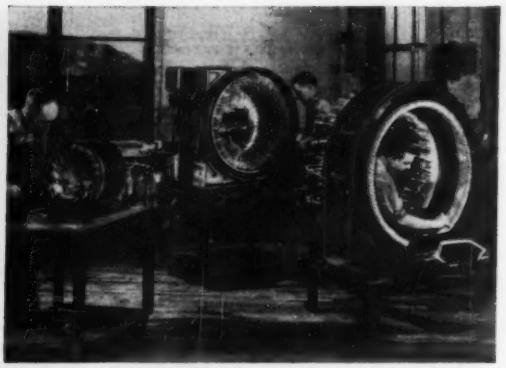
Represented in Principal Cities

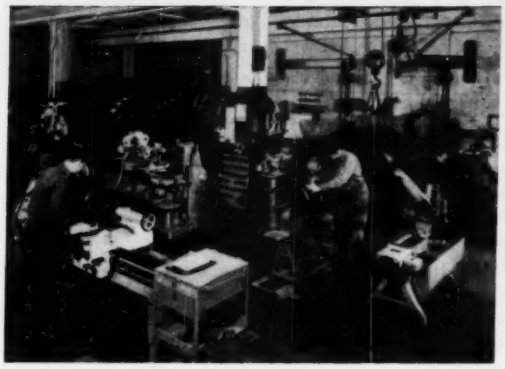
Empire State Building, New York 1, N. Y.

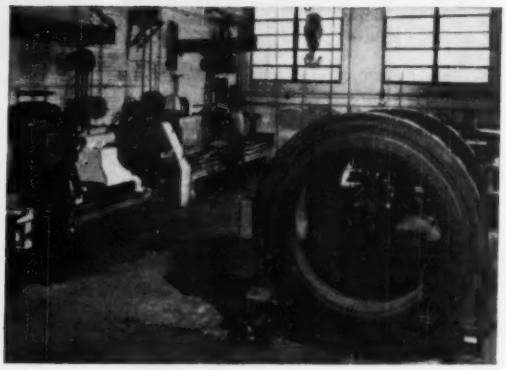
SARCO CANADA, LTD., TORONTO 5, ONTARIO

SARCO SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT







For Any Size Motors

DEPEND ON REPAIR SERVICE LIKE THIS!

Example: a Midwest Utility recently burned out a vital 75 hp motor. They called Chicago Electric, their nearby A-C Certified Service Shop, at 11:00 a.m. At 4:00 p.m. the *same day*, Chicago Electric had the unit repaired and back in service! Total time: 5 hours.

WHEREVER YOU ARE, you can get quick, dependable service from your nearby A-C Certified Service Shop, for there are over 75 such shops in all major industrial areas.

These shops have been selected on the basis of, **1)** quality of their work, **2)** facilities, and **3)** their community reputation. They maintain experienced personnel and use factory parts or parts of equal quality. They can be relied on for good work at honest prices.

When you need this kind of repair service on motors, controls or transformers, call your nearest Allis-Chalmers Certified Service Shop.

Need New Motors Or Starters?

For motors from one hp up to the largest sizes — with Allis-Chalmers controls to match — call your nearby A-C Dealer or Sales Office.

A-2949

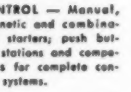
ALLIS-CHALMERS, 1171A SO. 70 ST. MILWAUKEE, WIS.

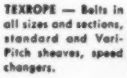
Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.





PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

WeldELLS®

Whatever you seek on that next welded piping job...*speed*...*economy*...piping for *extreme conditions*...piping to withstand *corrosion*...you will find the answer to it in piping welded the WeldELL way.

You will find the answer because the WeldELL line incorporates job-speeding, cost-cutting features that are combined in no other welding fitting.

You will find the answer because the WeldELL line expresses the best of all we have learned in fifty years of intensive specialization in forged fittings for designed piping and pressure vessels.

The WeldELL line also goes beyond all others in range of sizes, types, thicknesses and scope of materials. Form a good habit—the WeldELL habit. Your reward will be the deep-down satisfaction of using the best there is! Coupon brings catalog.

Taylor Spiral Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.

TF

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities.
Eastern Plant: Carnegie, Pa. • *Western Plant:* Fontana, Calif.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.
☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

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POSITION_____
COMPANY_____
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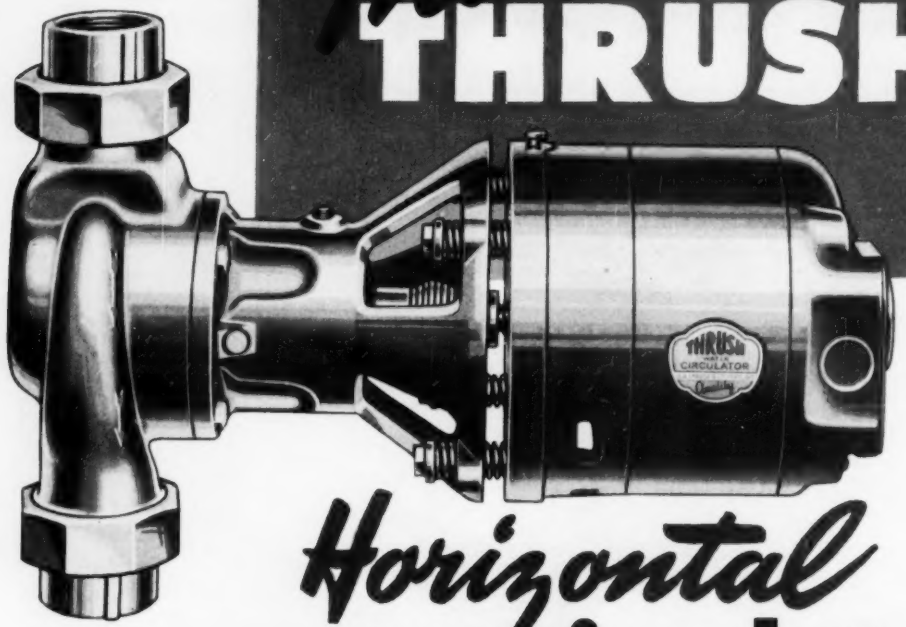
CITY_____ ZONE____ STATE_____

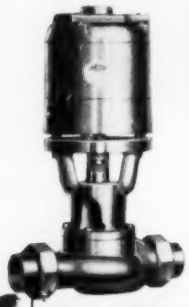
510-0350 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

IMPROVED!

The New! THRUSH



Horizontal water circulator



ALSO VERTICAL MODELS

THRUSH Horizontal Water Circulator is new! But it's the same fine, efficient circulating pump and incorporates all the time-tested features that have made Thrush Circulators superior through the years. It has sealed-in lubrication and the patented, flexible spring coupling and motor connecting springs which assure permanent alignment between motor and impeller shaft. Has double oil and water seals. The principal difference is the motor suitable for horizontal operation. Vertical types are still available. You may have either type you prefer.

★ **A life-time pump . . . grooved bearing circulates oil over moving surfaces constantly.**

★ **Ground and polished stainless steel impeller shaft with perfectly balanced brass impeller.**

★ **Positive circulation with quiet, smooth operation, free from service troubles.**

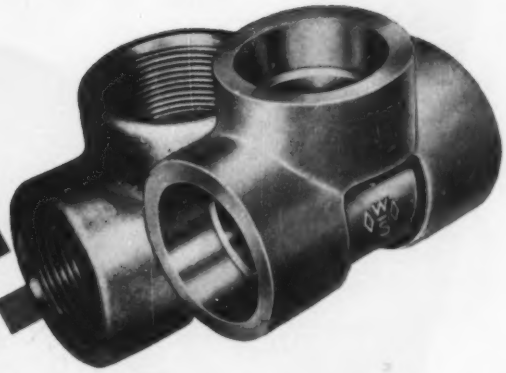
ASK YOUR WHOLESALER
OR WRITE DEPT. E-3 FOR MORE INFORMATION

H.A. THRUSH & COMPANY

PERU · INDIANA

FORCED CIRCULATING HOT WATER HEAT

first



AND THE LAST WORD
in forged steel fittings for all industries . . .

CARBON STEEL
Low Sulphur, Low Phosphor
High Tensile, High Weldability

ALLOYS
Stainless types 304—316—347
Chrome Moly—Carbon Moly—
Chrome Carbon Moly—Monel
Special alloys for Low Temperatures

W-S on Forged Steel Fittings, produced in commercial quantities—has been and still is the last word in dependable, trouble-free screw end and socket weld fittings service for ALL INDUSTRIES. Here's Why:

Reflected in the manufacture of every W-S *Forged* Fitting is a specialized knowledge of its end use by a particular industry. Beginning with selection of the right material from a wide choice of carbon and chrome-alloy steels, each W-S *Forged Steel* Fitting is tailor-made for a specified application:

Is high temperature, high-pressure STRENGTH a problem? W-S has been supplying intermediate alloy fittings to the power industry for many years. Want CORROSION RESISTANCE? W-S provides a full range of the popular stainless grades for all chemical processing requirements. Need PROTECTION against contamination and discoloration? Many food and drug processing plants use W-S 18-8, type 304, for full assurance of SANITATION . . . have for years. Plagued by INTERRUPTED SERVICE due to fittings failure under conditions of shock, vibration, and erosion? Industry after industry . . . and commercial and institutional users as well . . . have discovered the long-range ECONOMY of forged, life-of-the-system joints, as compared to any other kind.

Be sure that you have the right answer to your next fittings problem . . . before it arises: write for W-S Bulletin A-3, today.

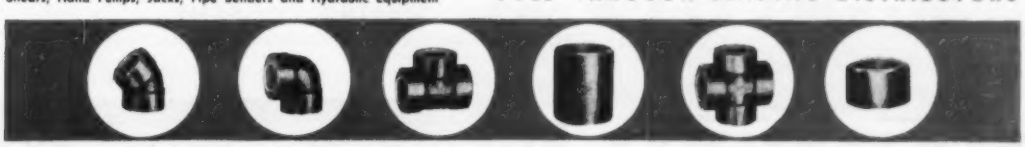
50A

WATSON-STILLMAN

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

ROSELLE, NEW JERSEY — Established 1848

SOLD THROUGH LEADING DISTRIBUTORS



NOW! AT NO INCREASE IN COST TO YOU

Makes a good steam trap better

Nearly 650,000 Yarway Impulse Steam Traps have already been installed—proof that they are doing a good job.

Now a *stainless steel* body makes this famous little trap even *better—at no increase in cost.*

Better in *wear*, better in *service*. Users will find Yarways require less maintenance than ever. All parts are wear-resistant, practically wear-proof. There is only one moving part, a small, stainless steel, heat-treated valve. Important, too—Yarway Impulse Traps are *suitable for all pressures up to specified maximum without change of valve or seat.*

Other popular advantages are *small size, light weight, easy installation* and *low cost.* Often it costs *less* to buy a new Yarway trap than to repair an old, ordinary trap.

In performance—ask any user. They all say Yarways are the traps that *get equipment hotter sooner and keep it hot!*

For better steam trap performance, try *new* stainless steel Yarways.

YARWAY IMPULSE STEAM TRAPS ARE SOLD BY OVER 200 DISTRIBUTORS. THERE IS ONE NEAR YOU.

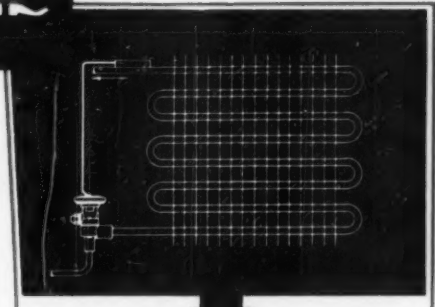
Write for name and address.

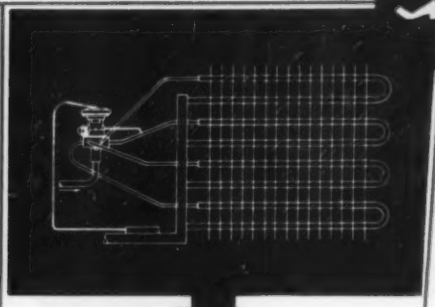
YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP

Control your coils more efficiently with these "twin"

ALCO THERMO VALVES





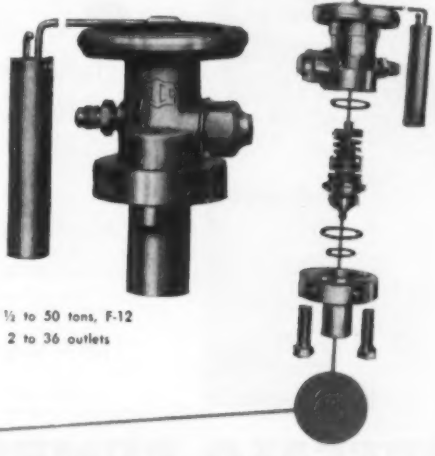
SINGLE OUTLET

SINGLE OUTLET for single path coils or independent distributing devices. Minimum moving parts for less friction. Automatic hydrogen welded for extra long life. Assures maximum efficiency obtainable with conventional type distribution.

¼ to 50 tons, F-12
½ to 100 tons, methyl chloride

MULTI-OUTLET

MULTI-OUTLET for greatest evaporator efficiency. Same simple "come-apart" construction and advanced design as Single Outlet type. Uniform distribution within the valve itself eliminates hunting, assures control, full utilization of coil capacity.



½ to 50 tons, F-12
2 to 36 outlets

25

A QUARTER-CENTURY OF PIONEERING AND PROGRESS

ALCO HAS REFRIGERATION UNDER CONTROL

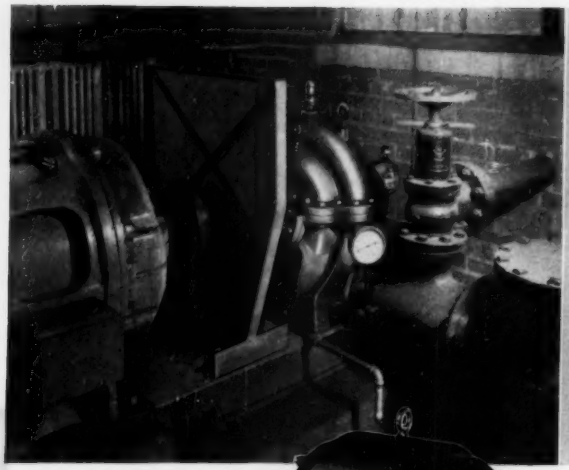
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

4221

SEE YOUR ALCO WHOLESALER
Parts stocked by leading wholesalers everywhere.



LONG ON THE JOB SHORT ON REPAIRS

"Buffalo" Pumps

Above, "Buffalo" "CS" Pump, one of a complete line of centrifugal pumps for every chemical liquid

Users in every branch of industry report two things about "Buffalo" Pumps: (1) they stay on the job for years with minimum maintenance, and (2) they do their given jobs efficiently.

It's costly to buy a "temporary" or inefficient pump just to save a few dollars on first cost. Write for Bulletins 953-G, 980-B and 982—see how "Buffalo" Pumps pay off in long-term efficiency!

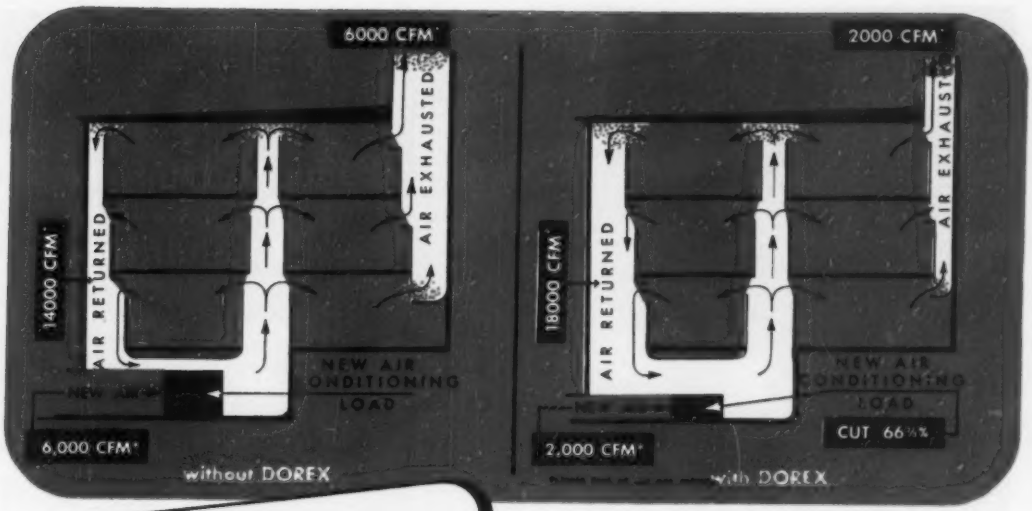
BUFFALO PUMPS, INC.

171 MORTIMER ST. BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

"Buffalo" PUMPS

Branch Offices in All Principal Cities

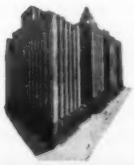


How Much Money can Dorex Air Recovery save?

Briefly, here's the answer: Every 1,000 cubic feet of conditioned air that is exhausted per minute costs over $200.00 a year. If, for instance, you are exhausting 6,000 CFM, you are, in effect, throwing out $1,200.00 worth of conditioned air.

Suppose Dorex could cut that only in half. That would mean $600.00 worth of conditioned air saved. But Dorex has been able to cut air conditioning exhaust—and the unconditioned outdoor air needed to replace it—*as much as 75%* in many cases.

Dorex changes *used* indoor air back to its original outdoor freshness by removing the odorous gases that make the air stale, stuffy and unpleasant. With Dorex, you can recirculate more of the indoor air you have already heated or cooled, cut down your outside air intake and reduce your equipment and operating cost.



The Criminal Courts Building in New York saves money with Dorex. This famous building is just another one of the 5,000 Dorex installations furnishing more and better air conditioning at lower cost.

Net saving for each 1000 CFM recovered averages $240.00

Based on year-round conditioning system in average temperate zone.

Cost to condition 1000 CFM outdoor air per annum

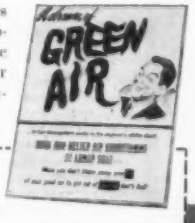
Refrigeration Machinery (3 tons @ $250.00)	$750.00	
Heating Equipment (100,000 BTU @ .0025)	250.00	
15% Interest and Amortization on $1,000.00		$150.00
Power (Average 1.5 tons x 1 KW x 1200 hrs. x $0.02)		36.00
Oil (Average 0.47 gals. x 2600 x .08)		98.00
Water plus pumping cost (based on Cooling Tower)		10.00
		$294.00

Cost to recover 1000 CFM recirculated air per annum

DOREX Air Recovery Equipment installed	$160.00	
15% Interest and Amortization on $160.00		$ 24.00
Carbon Reactivation Cost (once per year)		30.00
		$ 54.00

Net annual savings per 1000 CFM $240.00

Engineers, contractors and dealers who have this book say it's a helpful "sales tool" in convincing those who are reluctant to invest in air conditioning in these "cost-conscious" days.

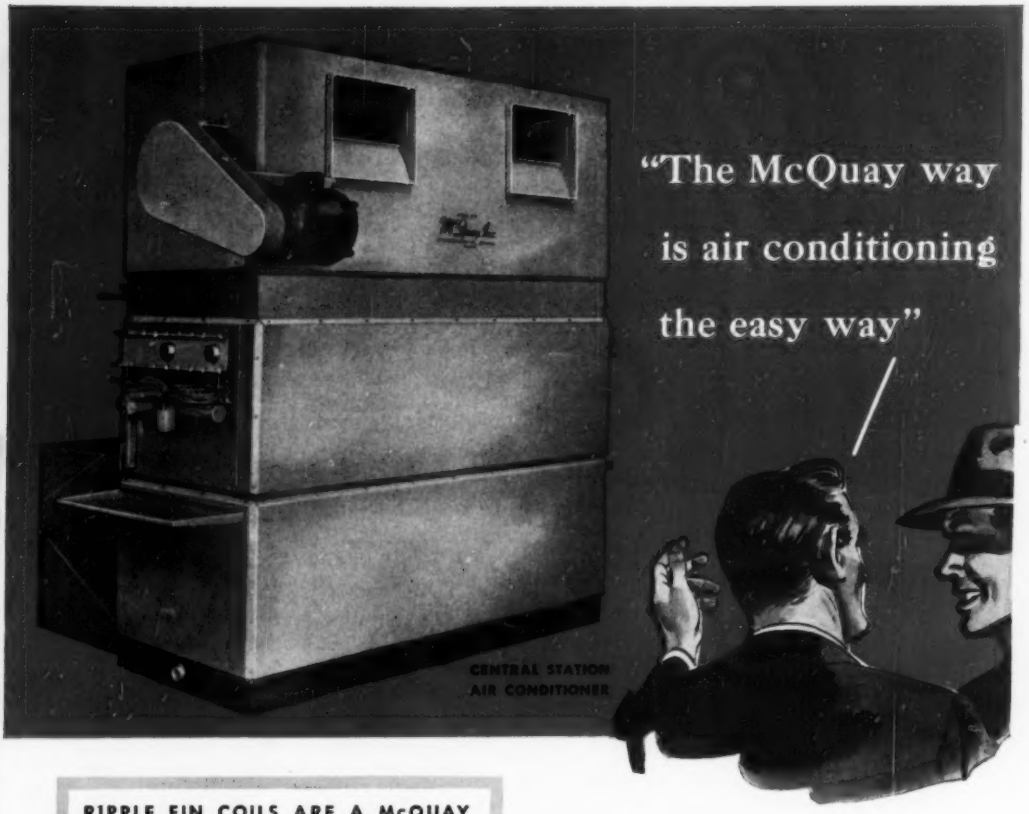


FREE BOOK
W. B. Connor Engineering Corp.
Dept. D-13, 112 East 32nd St.
New York 16, New York.

I'm interested in saving money on air conditioning. Please send me my FREE copy of "Green Air."

Name _____
Position _____
Company _____
Street _____
City _____ Zone _____ State _____

W. B. CONNOR ENGINEERING CORP.
Air Diffusion · Air Purification · Air Recovery
112 East 32nd Street — New York 16, N.Y.
IN CANADA: Douglas Engineering Co., Ltd., 130 Murray Street, Montreal 3, P.Q.



RIPPLE FIN COILS ARE A McQUAY "EXCLUSIVE"

Many physical sizes to choose from, each complete with distributor cup or cups that assure longer, more positive and more even performance, for commercial and industrial applications using Freon or Methyl Chloride refrigerants.

Direct Expansion Coils

Wide selection of coils for use with water and other fluids for commercial and industrial applications. All McQuay coils are hydraulically expanded to assure highest heat transfer efficiency. Special coils also available.

Water Cooling Coils

You'll find that McQuay's central air conditioning units have been designed to promote *ease of installation*—maximum serviceability.

Sectionalized construction includes completely removable panels for *easy maintenance*. All connections are exposed and conveniently grouped to simplify installation and servicing.

Through increased range and flexibility, these units provide better air conditioning efficiency to both the comfort and the process fields. Eight models are available, in capacities of from 3 to 50 tons.

For air conditioning the easy way . . . the right way . . . specify McQuay equipment having Ripple Fin coils, long famous for heat transfer efficiency.

AIR CONDITIONING
REFRIGERATION
HEATING

McQuay INC.

1601 Broadway Street Northeast • Minneapolis 13, Minnesota

Kno-Draft

. . . the completely adjustable Air Diffusers, specified by Western Union for big, high speed communications center at Philadelphia

In spaces filled with mechanical equipment, cable racks, transmitting machinery and storage partitions, Kno-Draft's facility for delicate regulation of air volume and direction enabled the air conditioning engineers to produce precisely the air pattern best suited for the purpose of each area in the communications center.

The system was balanced to within 5% and the temperatures equalized so evenly that measurements showed a maximum difference of only one-half degree throughout.

FREE HANDBOOK—Send for FREE copy of new handbook on air diffusion. Complete information on Kno-Draft Adjustable Diffusers and all necessary engineering data to help you create "custom-made" air patterns. Just fill in and mail the coupon.

These Kno-Draft features insure satisfaction.

Fig. 1.

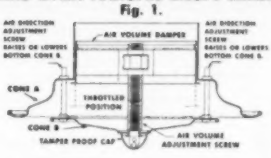
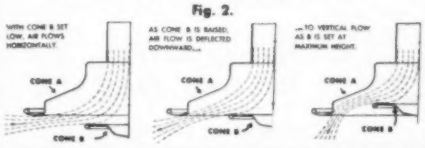

AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B.
AIR VOLUME DAMPER
AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B.
CONE A
THROTTLED POSITION
CONE B
TAMPER PROOF CAP
AIR VOLUME ADJUSTMENT SCREW

Fig. 1. Type D Air Volume Control consists of a cylindrical, sliding, sleeve-type damper, connected by a specially designed spider to a centrally operated screw. It varies only the quantity, not the characteristics, of the air distribution. Fig. 2. Any angle of air discharge can be obtained by raising or lowering bottom Cone B.

Fig. 2.


WITH CONE B SET LOW, AIR FLOWS HORIZONTALLY.
CONE A
CONE B
AS CONE B IS RAISED, AIR FLOW IS DEFLECTED DOWNWARD...
CONE A
CONE B
...TO VERTICAL FLOW AS B IS SET AT MAXIMUM HEIGHT.
CONE A
CONE B

W. B. CONNOR ENGINEERING CORP.

Air Diffusion · Air Purification · Air Recovery

112 East 32nd Street CONNOR New York 16, N.Y.

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Dept. D-23, 112 East 32nd Street, New York 16, New York

Please send my FREE copy of the new Kno-Draft Handbook on Adjustable Diffusers.

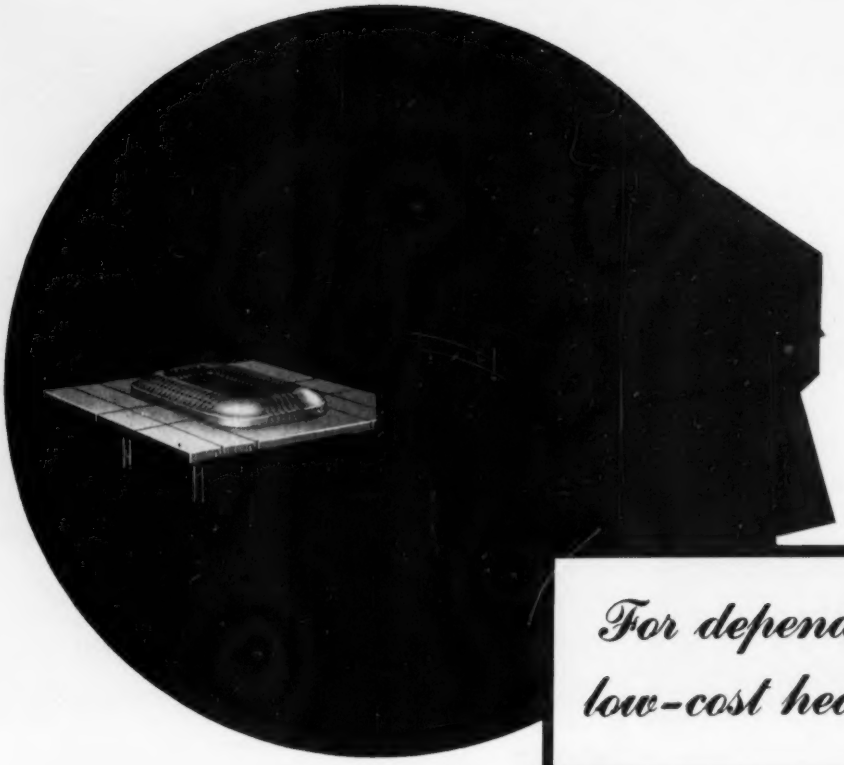
Name .....

Position .....

Company .....

Street .....

City ..... Zone ..... State .....



For dependable, low-cost heat . . .

IT'S THE

WILL-BURT STOKER

Advanced design and precise manufacture highlight the Will-Burt commercial stoker. Every part of every Will-Burt unit is designed, planned and produced for just one purpose—to provide dependable heat at low cost.

Thirty standard models are available, with capacities from 20 to 600 pounds of coal per hour. Hopper and bin-feed types throughout the entire capacity range assure you of the right size and style of stoker for your particular requirements.

You'll find Will-Burt commercial stokers wherever bituminous coal is burned—whether in Milford Center, Ohio, or Stockholm, Sweden. You'll find them in homes, churches, schools, stores and factories of all types and sizes. And wherever you find them, they'll be delivering constant, dependable heat at low cost.

Whether you buy, sell, or specify heating equipment, investigate Will-Burt. You'll find the highest in quality, backed by more than 56 years of manufacturing experience—more than 20 years experience in the design and manufacture of bituminous coal stokers. You'll find a sound dealer policy—a profit policy backed by service and quality—a policy which holds the loyalty of Will-Burt dealers year after year.

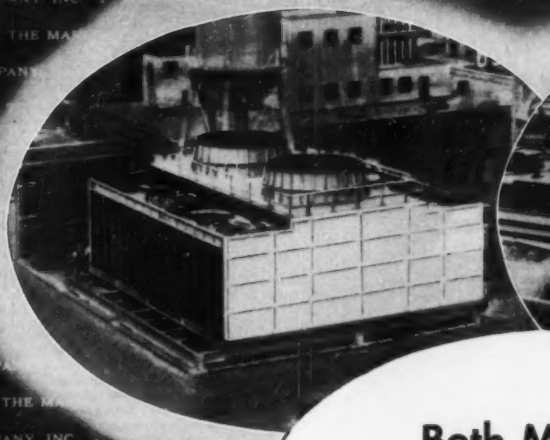
Your request for additional information will receive prompt attention.

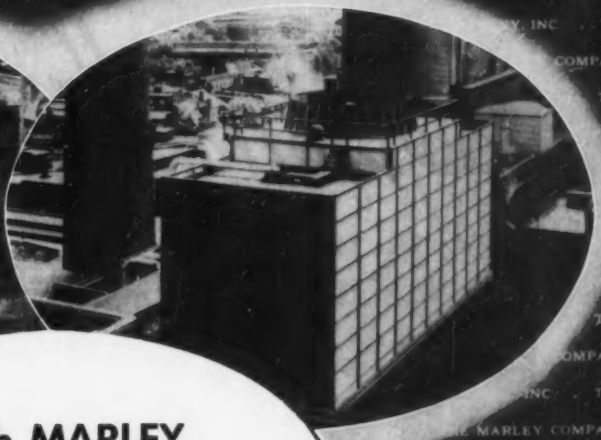
OTHER WILL-BURT HEATING PRODUCTS

Conversion oil and gas burners • Domestic oil-fired hot-water heating boilers • Coal, gas and oil-fired warm air furnaces

THE **WILL-BURT** COMPANY

DEPT. H ORRVILLE, OHIO





Both MARLEY Double-Flows *They're Different! Why?*

No two water cooling requirements are exactly alike! Water temperatures and gpm vary, horsepower requirements differ, space limitations are dissimilar, wet bulb conditions are not the same.

Recognizing this fact, Marley Double-Flow cooling towers are available in a wide range of sizes so you can fit a standard Double-Flow to your job . . . not the job to the cooling tower.

For example, the Marley Double-Flow on the left is used for air-conditioning service in a large department store in a climate where temperatures vary widely. Here it was desired to have a tower with four cooling cells and two fans to provide utmost flexibility . . . one, two, three or four cooling cells operating independently. A low silhouette was needed to save conflict with the city skyline. And, a broad-based tower allowed the weight to be distributed over a wide area. In order to meet a building code, the California redwood tower was cased with asbestos-board.

The Marley Double-Flow on the right was selected for one of the world's largest breweries. In this case, a tower was needed to cool a large gpm of water. Because of space limitations, the tower was erected on a high, elevated grillage with the area beneath the tower available for material storage. The cold water basin of the Double-Flow tower became the roof of the storage area.

These are only two of the hundreds of case histories in Marley files on operating Double-Flows that show how standard, low priced Double-Flow towers are expertly applied by trained application engineers.

Although sizes vary, all Marley Double-Flow cooling towers have many exclusive features . . . open distribution system, easy inspection and regulation, two independent cooling cells for each fan, nail-less filling, more drift eliminator area and Marley mechanical equipment. And, all Double-Flows are backed by the Marley guarantee.

Modern automatic machines and skilled craftsmen in three plants, enable Marley to furnish accurately fabricated towers to fit your job at a savings to you. If you have a water cooling problem, let Marley "know-how", starting in the blue-print stage, help you get MORE FOR YOUR MONEY by "custom tailoring" an economical, standard Marley Double-Flow to meet your specific needs.

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas HP-3

☐ I'd like to know more about DOUBLE-FLOW Cooling Towers. Please send FREE Bulletin DF-50.

☐ Have Engineer call, at no obligation to us, to discuss our water cooling needs. 000

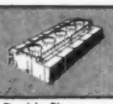
Name _____ Title _____

Company Name _____

Address _____

City _____ Zone _____ State _____

MARLEY



Double-Flow

Vairflo

DriCooler

Natural Draft

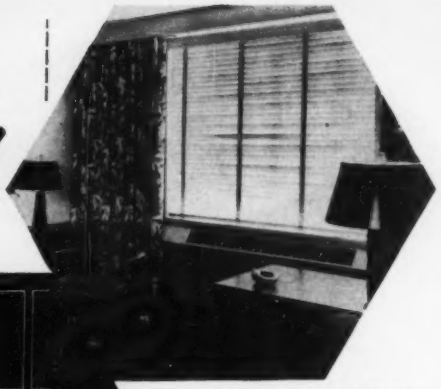
Counter-Flow

Aquatower

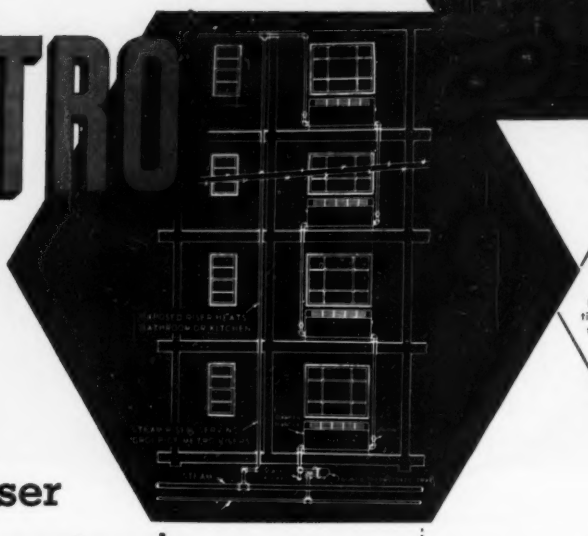
Spray Nozzles

Startling!!... Revolutionary!

'METRO



Living room in Fresh Meadows Housing Project, showing "Metro" convector. "Metro" piping is concealed behind draperies.



Single-riser provides an uninterrupted path for flow of steam from top to bottom of building. A continuous pipe passes down through overlying rooms... is offset in each room into a convector or baseboard.

the single-riser heating system!

- **Eliminates traps and valves in occupied quarters. Only trap is at bottom of riser in basement.**
- **Eliminates all radiator branches.**
- **Eliminates furring of walls.**
- **Permits pre-cutting risers, all one size, in shop.**
- **Benefits contractors, owners and tenants.**

Economical to install, operate and maintain . . . "Metro" piping with Vari-Vac* control is the proved heating system selected for large-scale housing projects financed by The Metropolitan, Equitable, and New York Life Insurance Companies.

"Metro" keeps fuel bills at a minimum. Heat supply and demand are always in perfect balance because steam temperature is automatically regulated according to outside weather. In addition, damper controls permit individual room heat regulation.

Dunham Vari-Vac Heating . . . the system that makes "Metro" possible . . . cuts fuel costs up to 40%—A Dunham Vari-Vac Differential Heating System is adaptable to any size structure . . . old construction as well as new. A Dunham Sales Engineer can quickly tell which of seven different size Vari-Vac systems you'll want to install.

SEND FOR FREE BULLETIN

Write today for your free copy of Bulletin 643, giving complete information about economical "Metro" piping. C. A. Dunham Co., 400 W. Madison St., Chicago 6, Ill. *In Canada:* C. A. Dunham Co. Ltd., Toronto. *In England:* C. A. Dunham Co., Ltd., London.

*Variable Vacuum

CONVECTOR RADIATION, BASEBOARD RADIATION

UNIT HEATERS

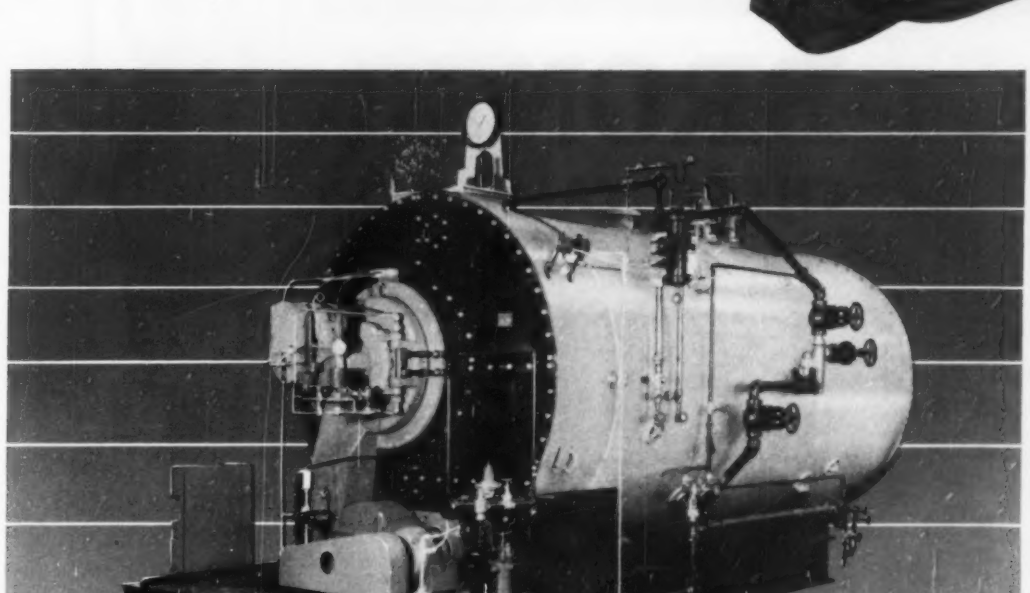
DUNHAM

TRAPS, VALVES, PUMPS

HEATING MEANS BETTER HEATING

A NATION-WIDE NETWORK OF FACTORY-AUTHORIZED SERVICE

. . . Another Reason Why You Get A Greater Return From Your Investment In A Cleaver-Brooks Steam Boiler



Nothing is more important than dependable operation of your steam boiler — vital to such operation is proper maintenance and service.

Cleaver-Brooks steam boiler service facilities are national — through factory-trained and authorized service organizations. Service begins with starting of your new boiler. It is placed in operation and fully tested under load by Cleaver-Brooks service-representatives. Your operators are trained in operation, care and maintenance.

Burn the available fuel in your area — gas or oil — with equal efficiency: Through their high heat transfer Cleaver-Brooks boilers operate at a guaranteed efficiency of 80% from full load down to 30% of rating, burning gas, oil, or combination gas and oil. No high or costly stacks (a simple roof vent carries off combustion gases)—no special foundations needed. Fit low head-room areas — provide quick steaming, flexible operation to meet fluctuating loads — eliminate ash handling. Cleaver-Brooks boilers fully meet all codes — available in sizes 15 to 500 H.P. — 15 to 200 P.S.I. Write for new, just published catalog.

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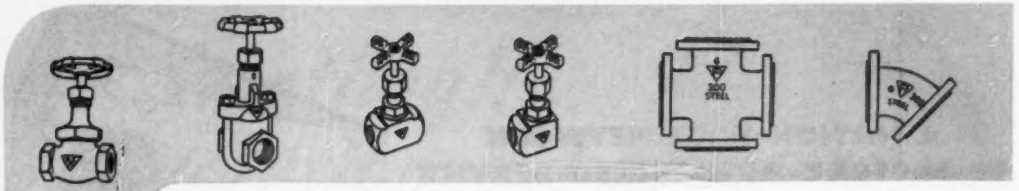
367 East Keefe Avenue, Milwaukee 12, Wisconsin

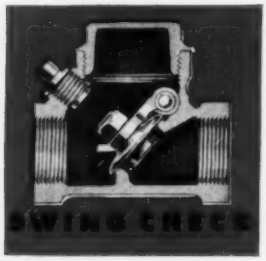
NEW — *The Cleaver-Brooks steam boiler Catalog—interesting—informative—beautifully illustrated. Write—on your business letterhead for your copy.*

Cleaver-Brooks
STEAM BOILERS

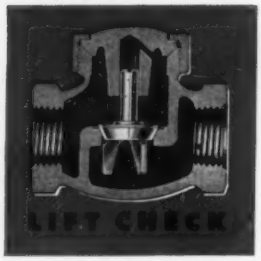


Quick-Acting · Positive · Dependable

BRONZE CHECK VALVES by R·P&C



• For use where flow is not pulsating—where velocity is low or moderate. Has renewable disc, regrinding seat. Disc free to rotate, thus distributes wear uniformly over disc and seat.



• For services where flow is pulsating or velocity high. Generally used with Globe and Angle valves. Resistance to flow greater than Swing Check. Suitable in horizontal lines only.

***For information** about bronze, iron and steel globe, angle and check valves — bar stock valves — iron cocks — cast steel fittings — get in touch with your R-P&C distributor.*

ACCO

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R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

READING-PRATT & CADY VALVES

This is *not* a callback!

It's a happier day for your men (and more profitable for you) when they spend their working hours on *new* installations.

There are days and days like that in the life of the heating and ventilating contractor who depends upon Bryant equipment. His customers, singing the praises of heating and water heating installations that never let them down, have no cause to phone for servicemen.

Take a good look at some of his other advantages, too. A single source of supply for all types of quality gas heating equipment for every industrial, commercial or housing project. A near-by distributor who offers prompt deliveries and helpful engineering service. A brand name known and quickly approved in his specifications.

Perhaps *you* have had the urge to check into the possibilities of Bryant equipment on those important jobs coming up. We're always at your service. Just say the word.

Let the pup be furnace man ...and water boy, too!

bryant

AUTOMATIC HEATING

The most complete line of gas heating equipment in the nation

Bryant Heater, Dept. 151,
17825 St. Clair, Cleveland, Ohio

( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

Name _____

Company _____

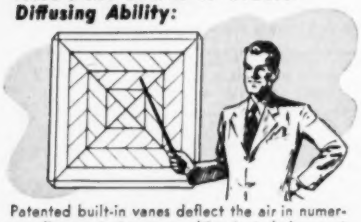
Address _____

City _____ State _____

Where? Anywhere* WITH AGITAIR®

Correct air distribution is achieved by Agitair Type R in new Macy's Kansas City.
Architect: Kivett & Meyers **Consulting Eng:** W. C. Cassell **Sheet Metal Con:** Gieske Sheet Metal Co.

Here's the Secret of Greater Diffusing Ability:



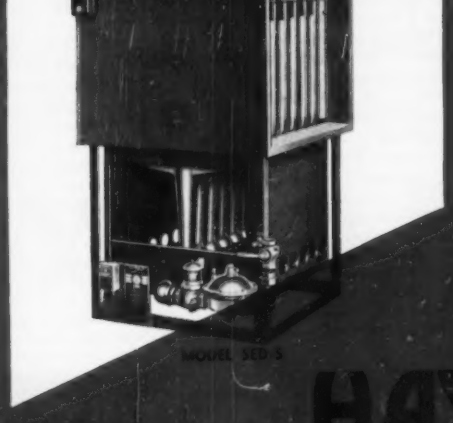
Patented built-in vanes deflect the air in numerous divergent streams resulting in turbulence at the point of contact with the aspirated air. Result: Rapid mixing, diffusion and temperature equalization.

*** • Center of Ceiling • Off-Center • Corner • Sidewall • Baseboard**

No Wonder more and more specifications call for Agitair Type R! It's tailor-made in design to suit conditions of each application. It assures 100% air distribution in any shape area, from any location — with no noise, no drafts, no blank corners, no hot spots, no cold spots. That's because Patented Vane Construction assures rapid diffusion. That's because Type R, RTC Agitairs are assembled into numerous patterns which divide the air and distribute it in one, two, three, or four directions in proportion to the area served. Get the facts today!

Write for Complete Data

AIR DEVICES, INC.
17 EAST 42nd ST. • NEW YORK 17, N. Y.
AIR DIFFUSERS • AIR FILTERS • ROOF EXHAUSTERS



MODEL SED-5

HAYES DUCT FURNACE SETS A NEW HIGH STANDARD FOR QUALITY . . .

1. Designed to be used as a direct fired heat exchanger for Industrial-Commercial and Air-Conditioning systems.
2. Requires less floor space than any other direct fired unit of comparable capacity.
3. Stabilized stainless steel heat exchanger and all welded construction insure long life.
4. Manufactured in 14 sizes to accommodate accurate BTU requirements.
5. Light weight compact design, saves space, labor and shipping costs.
6. Fan used to protect heat exchanger with dampers when furnace shuts down prevents cooling coils, also when condensation is probable.

For complete information and specifications write your General Dealer or

HAYES FURNACE MFG. & SUPPLY CO.
2929 South Fairfax Ave., Los Angeles 16, Calif.

HAYES DUCT FURNACE

BOYD ENGINEERING CO., 122 W. Gromlee, Albuquerque, New Mexico • BURNSIDE & CO., 379 Hilton Street, Atlanta, Georgia • BOOGHER-BARBECK CO., 2021 Cedar Springs, Dallas, Texas • BARRY HERRYOTT, 1329 Commerce Street, Denver, Colorado • BOYD ENGINEERING CO., 718 No. Santiago St., El Paso, Texas • W. L. GATHLEY CO., 550 Pacific Bldg., Houston, Texas • SMITH STEAM SPECIALTY CO., 3719 Temple Ave., Kansas City, Missouri • J. C. LEWIS, Pyramid Building, Little Rock, Arkansas • J. M. O'CONNOR CO., 3633 N. W. 36th, Oklahoma City, Oklahoma

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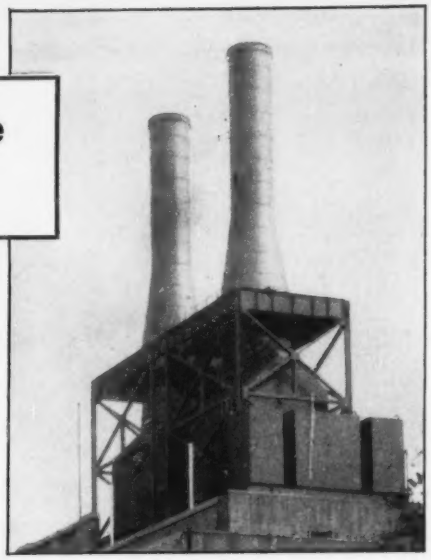
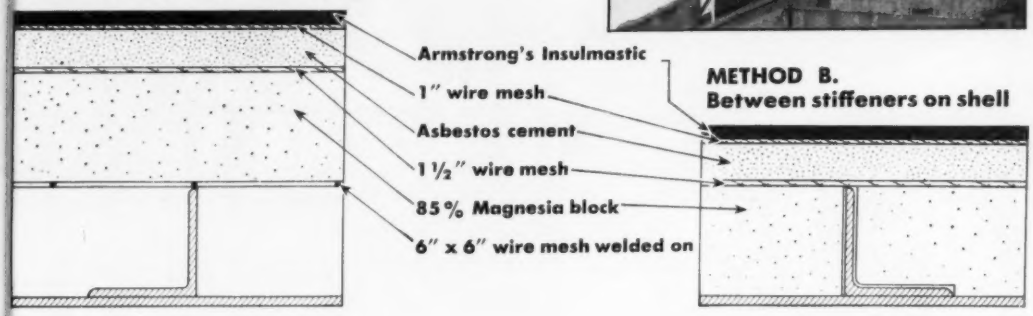
BOYD ENGINEERING CO., 16 South Third St., Phoenix, Arizona

How would you insulate these dust collectors?

To prevent moisture condensation and corrosion inside these dust collectors, they are to be insulated with a layer of 1½" thick 85% Magnesia. How would you apply the insulation?



METHOD A.
Over stiffeners on collector shell



Here's what the Armstrong engineer recommended:

Of the two methods shown above, the application of the insulation over the stiffeners is most practical. The insulation is applied over 6" x 6" wire mesh, welded to the stiffeners. This mesh absorbs considerable "weave" and guards against the insulation's cracking as the collectors expand and contract. Also, the cost of applying the insulation over the wire mesh is lower than fitting insulation between the stiffener angles.

Method A also has the advantage of providing full insulation protection over the entire surface. In method B, the only protection over the stiffener is the wire mesh, plaster, and Insulmastic finish. The "weave" of the collectors will cause cracking at these points.

Helping you arrive at the most practical solution to any heat insulation problem is part of the day-to-day job of Armstrong engineers. In addition to this engineering help, Armstrong's Contract Service provides you with top-quality insulating materials and skilled workmen to apply them. The next time you need heat insulation to save fuel or to improve the operation of a piece of equipment, call the Armstrong District Office nearest you for full information.

NEW BOOKLET—Send today for your free copy of "Armstrong's Industrial Insulations." It contains valuable information on heat insulations, recommended thicknesses, and proper methods of application. Write to Armstrong Cork Co., 4403 Maple Ave., Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS (A) INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

Save on Installation Costs with YOUNG CONVECTOR-RADIATORS

Cut away view of Young Type "F" Free-Standing Convector-Radiator. Inset shows detail of Young-designed adjustable heating element support.

Once again Young Engineering saves you money. A new heating element support cuts installation time and permits quick pitching adjustments. Its rigidity permits shipping core in position . . . another time saver. An additional Young innovation, unit packaging, also speeds handling on the job. Each sturdy carton is clearly marked for quick identification and protects units in handling. The Young Convector-Radiator Line includes a style and size for any hot water and two-pipe steam system. Mail the coupon below for further helpful information.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

T. M. Reg. U.S. Pat. Off.

Heating, Cooling, and Air Conditioning Products for Home and Industry.

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LEARN HOW YOUNG CONVECTOR-RADIATORS CAN CUT CORNERS ON HEATING BUDGETS

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Rush me full details about the Young Convector-Radictor Line, without obligation.

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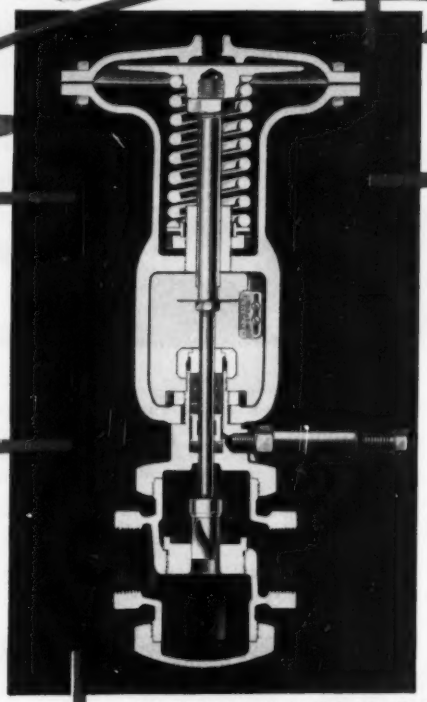
City_____ Zone____ State_____

FISHER TYPE 510-S

PRESSURE REGULATOR and DIAPHRAGM CONTROL VALVE



MATERIAL

Bronze and stainless steel bodies.

SIZES

½" to 2."

SERVICE

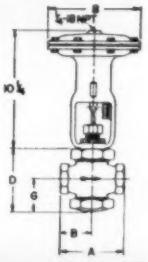
For direct action pressure regulators and reducing valves up to 50 pounds reduced pressure.

For 2 to 15 pounds pneumatic actuation with ¾" valve travel and utilizing popular Micro-Flute Pup inner valve, V-Port, Quick-Opening or Composition Disc inner valve in single seat valves—or available with double ported V-Port or Quick-Opening inner valve construction.

Particularly adapted to service where small size and compactness are desirable.

DIMENSIONS

SIZE	A	B	D	G
½	3⅝	1 13/16	3 15/16	1 15/16
¾	3⅝	1 13/16	3 15/16	1 15/16
1	4⅛	2 1/16	4⅝	2⅜
1¼	4⅛	2 1/16	5	2½
1½	4⅞	2¾	5½	2⅞
2	5¼	2⅞	6½	3 3/16



FISHER GOVERNOR CO. Marshalltown, Iowa

You wouldn't light a room with a **SPOT LIGHT!**

One lamp, if it were large enough, might meet the candlepower specifications for a given lighting area *but* such an arrangement would be far from satisfactory for obvious reasons . . . by the same token, a heating unit that concentrated all the BTU requirements for a *heating* area in a single source would not provide the even distribution of heat that health and the desire for comfort demands.

Pat. applied for

VULCAN fin-tube continuous-line BASEBOARD radiation installed along the outside walls of a room assures perfect heating comfort in all parts of the room area . . . wall-to-wall and floor-to-ceiling.

Vulcan — Easy To Install: Vulcan may be ordered in any desired length (in increments of 1") up to 12 feet for either steam or forced hot water. Comes cut to length, ends threaded or chamfered for welding. Requires few fittings and supports. Shipped uncrated, crated or cartoned.

Vulcan — Guaranteed Quality Construction: Units are fabricated from seamless steel pressure tube or copper water tube. Fins guaranteed to remain tight under conventional operating conditions. *Vulcan installations in use 22 years still in top operating condition.*

Ask your Vulcan representative about Vulcan Standard for commercial installations too.

REPRESENTATIVES IN PRINCIPAL CITIES

THE VULCAN RADIATOR COMPANY

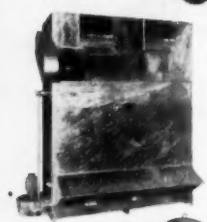
26 FRANCIS AVENUE **HARTFORD 6, CONN.**

ACME PRODUCTS

INDUCED DRAFT COOLING TOWERS

Dry-Ex Water Chillers

Freon and Ammonia Condensers



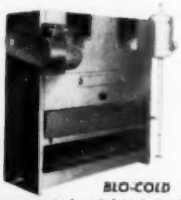
Evaporative Condensers

Oil Separators

Shell and Coil Condensers

Liquid Receivers

Heat Exchangers



BLO-COLD Industrial Unit Coolers

Acme

TAKES PRIDE—

—in announcing a new addition to a distinguished line of air conditioning and refrigeration products—the Induced Draft Cooling Tower.

Carefully designed and engineered to meet the high standards of Acme products—yet moderately priced through skillful manufacturing methods, Acme Induced Draft Cooling Towers are now available in sizes and capacities from 3 to 40 tons. You'll find many improvements and refinements over ordinary cooling towers. For example, the cooling pads are made of a new non-metallic material and ***will not corrode.*** Pads will hold water in suspension and give an extensive wetting surface with a minimum of bulk. Towers are easily accessible and serviced. Like the Acme Evaporative Condenser, all metal parts are ***hot-dip galvanized after fabrication.***

But you'll want to have all the details. New catalog No. 40 is just off the presses. Write for yours today.

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Serving the refrigeration industry since 1919

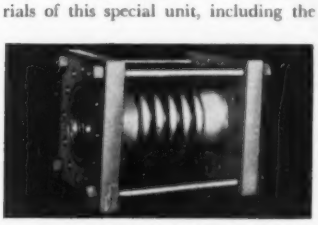
Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

HIGH PRESSURE TOROIDAL TYPE

Often we are called upon to design and build expansion joints for special applications which require extreme pressure or temperature service. Recently a large manufacturer had a problem involving testing of classified aeronautical equipment and called on us. After careful analysis of operating conditions, our engineering staff developed high-pressure toroidal stainless steel expansion joints for use on a 700 lb. liquid oxygen service line, operating at minus 320° F. All materials of this special unit, including the



flanges and rods, are of stainless steel for dependable operation at extremely low temperatures. The handling of this unique problem might suggest a possible answer to the expansion problem you now face. For many years, our concentration upon the manufacture of *one* product only—expansion joints—has resulted in the gaining of special skill and broad experience, which enables us to offer you *qualified engineering* service and *unexcelled products*. At all times, we welcome your inquiry.

. . . a complete, practical catalog on all Zallea Expansion Joints. A text book and a valuable reference source. Send for your *free* copy *today!*

ZALLEA BROTHERS, 816 Locust Street
Wilmington 99, Delaware.

Why Zallea Joints Last Longer

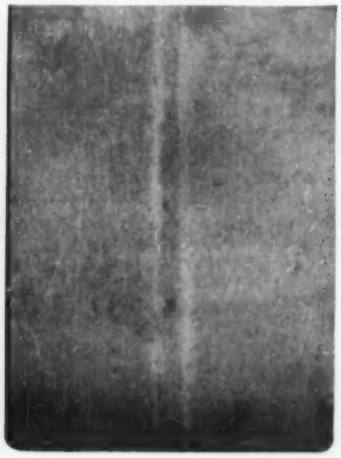
FREQUENTLY we are asked why our stainless steel expansion joints stand up where others have failed. There are several reasons, but *one* important factor involves the pickling and passivating process we employ in the *controlled* manufacture of all our joints. After final heat treatment, all scale is removed by pickling in several acid baths, followed by passivating. Scale formed during annealing will rust, and if not removed, will cause corrosive attack and pitting of the metal itself.

Test Shows Why

The unretouched photographs below illustrate the importance of scale removal. Two strips were cut from the same sheet of stainless steel. Both were annealed. Surface scale, which resulted from this operation, was allowed to remain on one sample while the other was pickled and passivated. Both samples were then exposed to the weather for a period of only ten days! Note the result: the *untreated* sample on the left is completely covered with rust, while the other is as clean as the moment it left the acid bath. Consider this important factor in the expansion joints you buy, for a rusted joint—*even before installation*—is well on its way to early failure. Call our nearest representative and he will show you similar samples.

Controlled Manufacture

Extra care in pickling and passivating all stainless steel expansion joints is standard practice with Zallea. Temperatures, concentration of the acids, and the length of pickling time are carefully controlled. Finally, after several pickling operations, the stainless steel expansion joints are passivated in nitric acid to produce a surface which is in the best condition to resist corrosion. Such care in *controlled* manufacture results in the Zallea Expansion Joint as many know it—durable, dependable, and maintenance free. When you want to be *sure*, always specify ZALLEA.



COMFORT INSURED BY NEW YORK LIFE

WITH B&W STEAM

Four B&W Integral-Furnace Boilers, Type FF, installed at Fresh Meadows' central heating plant.

Boldly conceived and daringly executed, the new Fresh Meadows 170-acre residential community and shopping center in Long Island, N. Y., is one of the largest and finest of its kind in the United States. Steam for heating the 154 business and residential buildings of this giant development is supplied by four B&W Integral-Furnace Boilers, Type FF, from a centrally located plant. Each of these boilers is capable of operating at a continuous rate of 44,000 lb. of steam per hr. at 200 psi, and at 55,000 lb. for emergencies. Normally oil-fired, the boilers are designed for conversion to stoker firing if desired.

Compactness, ease of simplicity of operation, fuel economy and flexibility, smokeless combustion, low maintenance, and reasonable first cost are some of the advantages of the B&W Integral-Furnace Boiler, Type FF, that make it so attractive for public, private and commercial buildings; institutions; and industrial plants requiring boiler capacities up to 60,000 lb. per hr. It is now satisfying the requirements of over 500 users ranging from airports to zoos.

Send for Bulletin G-64 describing and illustrating the many cost-saving features of this popular boiler. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

B&W

BABCOCK & WILCOX

G-448

THE EDITOR'S PAGES

MICROFILM HPAC TO BE AVAILABLE

THE KEENEY Publishing Co. has entered into an agreement with University Microfilms to make available to libraries issues of Heating, Piping & Air Conditioning magazine in microfilm form.

One of the problems facing all libraries is that of providing adequate space. Periodicals pose an especially difficult problem because of their bulk and number.

Microfilm makes it possible to produce and distribute copies of periodical literature on the basis of the entire volume in a single roll, in editions of 30 or more, at a cost approximately equal to the cost of binding the same material in a conventional library binding.

Under the plan, a library keeps the printed issues unbound and circulates them in that form for from two to three years, which corresponds to the period of greatest use. When the paper copies begin to wear out or are not called for frequently, they are disposed of and the microfilm is substituted.

Sales are restricted to those subscribing to the paper edition, and the film copy is only distributed at the end of the volume year.

The microfilm is in positive form and is furnished on metal reels, suitably labeled. Inquiries concerning purchase should be directed to University Microfilms, 313 N. First St., Ann Arbor, Mich.

JANUARY CONTRACTS 51 PERCENT OVER YEAR AGO

F. W. DODGE CORP. has reported that contracts awarded for building and heavy engineering works in the 37 states east of the Rocky Mountains in January amounted to $730,855,000, a drop of 21 percent from December and an increase of 51 percent over January of last year.

Nonresidential awards amounted to $235,294,000 in January to show a decline of 22 percent from December and an increase of 6 percent over January a year ago. All major nonresidential classifications were off from December's total excepting social and recreational building. Compared with January of last year, educational and science building awards were up 67 percent, and slight gains were reported for religious building but other classifications were off, the sharpest decline being shown for commercial buildings.

Residential contract volume amounting to $343,501,000 in January reflected an 18 percent decline from December and a gain of 116 percent over January a year ago. Both apartment house and single-family house construction were up substantially over January 1949.

Heavy engineering awards amounted to $152,060,000 in January, or 27 percent less than in December and 49 percent more than in January of last year.

OFFICE CONDITIONING NEEDED FOR EFFICIENCY

IN A BULLETIN on air conditioning in 1950 issued by Syska & Hennessy, Inc., consulting engineers, New York City, it is pointed out that lack of comfort cooling, especially during the torrid days of last July and August, forced many firms to close their offices in the early afternoon. On these days many productive man-and woman-hours were lost to employers. Chances are that sales and even some customer goodwill were lost, too. When offices remained open, efficiency and morale of those employees who stuck to their jobs on hot and muggy days dropped to low levels.

Just how much in dollars the impacts of insufferably hot weather had on tenant profit-and-loss statements is, of course, impossible to pin down exactly. That these factors proved costly—*very* costly—is certain.

Equally certain is the fact that experiences of the last summer persuaded hundreds of firms to look into the possibilities for having their present quarters air conditioned, or to seek out new quarters that are so equipped.

Owners of office buildings without air conditioning installed will come under increasing pressure from tenants to modernize with comfort cooling equipment. Furthermore, these building owners face stiffer competition from modern air conditioned offices now built and others under construction.

All office buildings that are being erected today, and those still on drafting boards, include air conditioning. These modern structures offer in addition to air conditioning other tenant-attracting features such as smart appearance and vastly improved lighting. The new air conditioned buildings gain a competitive edge. Their owners can offer prospective tenants a more efficient working atmosphere that means higher employee morale, less hot-weather absenteeism and inefficiency.

Tenants, themselves, feel competitive pressure more keenly. They become more aware of the need to slash costs, to improve human relations, and to sell more aggressively. They'll have more reason in 1950, than ever before, to seek out air conditioning as a practical means for making their offices far more inviting places to work and to transact business in the hottest, muggiest weather, says the bulletin.

ENGINEERS CREATE WATER POLICY GROUP

THAT ADEQUATE conservation and development of the nation's water resources "are unattainable under present uncoordinated and frequently opposing policies" was the conclusion of a group of national engineering societies as they took action January 20 to mobilize the engineering profession in attacking the problem. Citing present practices that are detrimental to the nation's economic progress, engineers, working through the Engineers' Joint Council, have set up

THE EDITOR'S PAGES

task committees, covering various subdivisions of the fields of water conservation, development and utilization. Members of the engineering profession, specially qualified in these fields, will thus contribute their talents in important national public service.

The water policy panel thus created is developing basic engineering principles which engineers can advocate for inclusion in a program for a sound national water policy. These concepts will be presented to President Truman's temporary water resources policy commission.

Chairman of the new water policy panel is a recognized authority on water resources, a past president of the American Society of Civil Engineers, Wesley W. Horner, consulting engineer with headquarters in St. Louis.

The Engineers' Joint Council is a coordinating body of the engineering profession, composed of the officers of five principal national engineering societies, representing over 100,000 engineers.

CHAINS SPEND $31 MILLION FOR AIR CONDITIONING

THE NATION'S chain stores spent $31 million for air conditioning equipment in 1949, says Chain Store Age magazine. Reports from 517 chains operating 28,729 stores, or about 24 percent of all chain stores in the nation, provided the information on which the publication's study was based.

Air conditioning equipment is in operation in 18½ percent of all chain stores, according to the magazine.

Variety-general merchandise chains in 1949 spent $9 million for air conditioning equipment, and 23 percent of their stores are now air conditioned. Restaurant chains expended $5.5 million and 42 percent of their establishments are now air conditioned.

Dollar expenditures and the percentages of stores now air conditioned by chains in other fields, as reported by the publication, are: apparel, $4.9 million and 53 percent; grocery, $3 million and 4 percent; shoe, $1.6 million and 54 percent; drug, $1 million and 55 percent; auto accessories-hardware, $1 million and 9 percent; and other chains, $5 million and 15 percent.

The $3 million spent in 1949 by the grocery chains is especially significant, Chain Store Age pointed out, because these chains began to recognize the need for air conditioning only within the past few years.

WELDING LIBRARY CLASSIFIES PATENTS

THE DEPARTMENT of welding engineering at Ohio State university has announced completion of a new patent classification index in the A. F. Davis welding library, designed to make information on more than 12,000 U. S. patents on welding more easily available to industry and educational institutions.

Each patent in the library is classified or indexed in several different ways—by process, material, product, use, inventor's name, date of issue etc., on a single keysort card. These cards are sorted mechanically, and in very little time the numbers of patents pertaining to a given field may be determined.

The use of the patent classification system is offered to industrial organizations, individuals, and educational institutions. Services are free of charge to those who make use of the index system in person, but modest charges to defray clerical expense will be made for inquiries handled by mail.

AIR CONDITIONING BOOSTS RESTAURANT'S SALES

IF THEY GIVE comfort—as well as good food and service—to their customers, small and medium size restaurants can increase their business as well as their net returns, according to C. W. Horan, of the Colonial cafeteria, Fort Worth, in an article published recently in Food Service News. This involves first spending money for air conditioning, he said.

Comfort air conditioning "is one of the best methods of increasing volume that we have", he said, and he cited his own experience as follows:

"I have a small place. I was running about $9000 a month until I put in air conditioning. The first year of air conditioning, in the six months from May through October, I increased my gross $37,000. That is an average of $205 a day increase in gross sales. This is the second year and I checked the first six weeks of this year and my gross sales are up another $167 a day over last year. That is, by investing $8000 in air conditioning I have increased my gross sales from $9000 a month to $20,000 a month.

"It is time that a lot of the small or moderate sized places recognize the fact that they can serve their public, increase their business, and double their own net profit by spending a little bit of money. If they have faith in the fact that by giving good food, good service, and good comfort to their customers, they will profit by it. I think that is something that deserves consideration in the moderate sized restaurant as compared to the very large operation."

"QUOTE"

"Let us assume a certain tenant [of an office building] employs 10 people, each earning $3000 per year, or a total payroll of $30,000 annually. Each employee occupies 100 sq ft of space and the tenant is paying $3.00 per sq ft per year, or $3000 for this area. If, by careful planning, we can increase the efficiency of his employees by 10 percent as a result of a more cheerful atmosphere and better working conditions we have saved for him in dollars alone, the annual salary of one employee or the equivalent of the annual rent for the space occupied by 10 employees.

"Can this be done by decorating and merely rearranging his desks? Perhaps not. It may require new lighting or air conditioning which is also modernization without construction."—ALAN M. PURLING, of Arthur Rubloff & Co., in a talk on Modernization Without Construction at a conference of the National Association of Building Owners and Managers.

Georgetown University Hospital, Washington 7, D. C. Heated by 4-zone Webster Electronic Moderator System of Steam Heating. Architects: Kaiser, Neal & Reid, Pittsburgh, Pa. Consulting Engineer: F. J. Firsching, Pittsburgh. General Contractors: John McShain Co., Washington, D. C. Heating Contractors: Standard Engineering Co., Washington, D. C.

3-Year Heating Record

at Georgetown University Hospital

How the Webster Moderator System meets comfort requirements without wasteful overheating has been demonstrated in the new Georgetown University Hospital.

With the Webster Electronic Moderator System, this well-managed institution enjoys "Control-by-the-Weather" comfort. Each of the 779 radiators gets heat in the amount needed.

The report on the effectiveness of the Webster Moderator System was made by Sam S. Shepherd, Chief Engineer of the Hospital since its completion in 1947 and prior to that Chief Engineer of Georgetown University. Careful operation and a vigilant maintenance program have been important factors in the success of the heating installation.

In choosing the Webster Moderator System, designers of Georgetown University Hospital did not experiment. Similar Webster Moderator Systems serve in such outstanding institutions as the U.S. Naval Hospital, Bethesda, Md., Delaware Hospital, Wilmington, Del., Our Lady of Lourdes Hospital, Camden, N. J., and many others.

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WEBSTER
MODERATOR
SYSTEM
OF STEAM HEATING
"Controlled by the weather"

Report of Chief Engineer Sam S. Shepherd Georgetown University Hospital

"In my opinion, the Webster Moderator System embodies the best features to be found in controls for heating systems.

"As we have it here, the Webster Moderator System coupled with a properly installed zone system makes it possible for us to prevent underheating in severe weather and—even more important—we do not overheat in mild weather or during days with a normal variation in the outside temperature.

"My records show clearly that with the Moderator in use, the consumption of fuel for heating purposes follows very closely the degree day demand.

"This is encouraging to the operating engineer because he knows that here is a means to prevent waste of fuel from the very sources which are most prevalent in uncontrolled heating systems.

"Our installation is reasonably new. We are now in the third year of operation. Very few parts have been replaced and the control system is operating at peak efficiency."

10,264 NESBITT CONVECTORS in this new apartment project...

Lynnewood Gardens, on the outskirts of Philadelphia, embraces 126 acres. When completed, its 127 Colonial type buildings will contain 1,798 apartment units.

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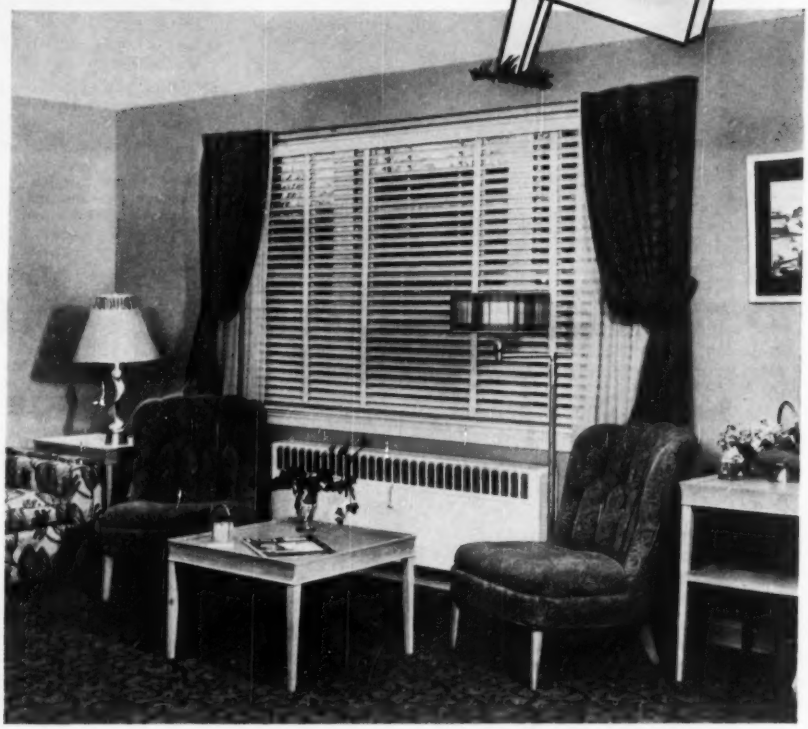
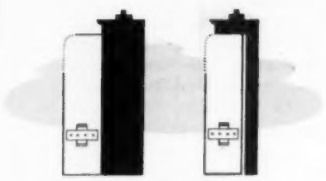
Tyson Construction Co.
HEATING: Plumbing & Heating Service Co.





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Every heating contractor can profit by the experience of the builders of Lynnewood Gardens—who did not choose just "any" convectors for their 1,798-unit apartment project, but after critical comparison of several good makes chose NESBITT MODEL U CONVECTORS. Quality, design, construction, finish, and the universal features which save manhours of installation time SOLD them. Owners and tenants are SOLD by the same worthy advantages. When you need COMFORT you need CONVECTORS. And whether it's one convector or a carload, you save time and money and service calls—with NESBITTS.

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Do YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to contribute your views on some other matter of interest to heating, piping, and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of allowing a period for discussion following presentation of a paper. You are invited to contribute your comments. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

HEATING CONTRACTOR "PLEADS GUILTY"

AS A HEATING contractor partially responsible for the duping of the public regarding this "indoor sun" misconception, I appreciate this opportunity of gilding my own conscience by at once pleading guilty and offering the inevitable excuse. First, however, I wish to congratulate F. W. Hutchinson for his interesting and very clear presentation of a point which has, I know, disturbed the precise, analytical side of many an engineer. Try as I may, I can find no quarrel with his arguments, as given in his article entitled The Myth of the "Indoor Sun," in the December HPAC.

Believe me, it is a heartless engineer indeed that can (without risk of inner conflicts, of course) assure the unknowing owner that he will design a "sun" and at a reasonable cost put it right in his building. That this is widely done is unfortunate and at the same time perfectly excusable, at least to my way of thinking.

Have you tried lately, Professor, explaining to the average nontechnical person why heat now comes down from the ceiling while they have known all their lives that heat always rises? Let us suppose that a skeptical layman confronts you with this question and gives you the usual very few minutes of his time for a satisfactory explanation. There should be a better answer than "If heat always rises, how does the sun heat the earth?" Can you think of that better answer? I willingly admit that I for one have tried it and failed. My excuse then is that I can do no better.

We do know, just as surely as we know we feel warmer standing in the sun than we do standing in the shade, that we can achieve comfort conditions in a panel heated space. I predict that future generations, in their elementary science courses, will learn that the sun is very much like the radiant panel heating system that heats their homes. I believe that in our dealings with the public we should concern ourselves less with how radiant panel heating works and more with the fact that it does work.—THOMAS E. KELLEHER, Kelleher Engineering Co.

CONTROLLED COOLING SUMMER AND WINTER

WE HAVE TO thank F. W. Hutchinson for exploding the myth of the "indoor sun" in his article in December. However, I think a note of warning should be given in connection with several basic points brought out by Professor Hutchinson.

Let us consider the statements that:

"Panel heating is successful because an extremely large percentage of the energy leaving the panel goes directly or indirectly into convective space heating. . . . A well designed panel heating system is therefore effective because it provides uniform space heating by convection. . . . it provides effective distribution of convective heating and hence is a method of raising the air temperature within an enclosure and of thereby establishing occupant comfort through general space heating. On this basis and in this way, panel heating does an effective job."

Many engineers will not accept the basic idea that panel heating provides uniform comfort conditions mainly by convective heating of the air in an enclosure.

The fact is that panel heating, like all other heating systems, should not "heat" people at all. On the contrary it should *cool* them but at a slower rate than is the case if no heating system is available. No doubt Professor Hutchinson has this in mind when he writes: "Such radiant advantage as may be possessed by panels is due not to the radiant energy that they may supply to the occupant but rather to the reduction in radiant losses to the cold floor, ceiling or walls that the occupant might otherwise experience."

The photograph on page 74 of the December article showing a bather in air below freezing point is sure evidence that convection has nothing to do with the comfortable feeling we experience when staying in direct sunshine on a cold winter's day.

What actually happens with the specific case of the "outdoor sun" is that our body radiation loss is comfortably reduced not only due to direct radiation and that reflected by the white glittering snow, but also due to the raising of the surface temperature of the surrounding walls and ground by infra-red rays from the sun.

Higher surrounding surface temperatures may not necessarily mean radiation to the body since the latter may be warmer than the surface, but it certainly results in reduced body loss not only on the sun-bathed side but also on the remaining surface area in the shade and facing the sun-heated ground and walls.

With floor panel heating a similar action takes place and the pronounced comfort conditions obtained with it, even with open windows, are due to the walls and ceiling receiving considerable radiant heat from the floor, thereby increasing their respective surface temperatures rapidly.

Thus the fact that wall and ceil-

ing surface materials have absorptivities of the order of 95 percent as pointed out by Professor Hutchinson, is an advantage rather than otherwise in radiant heating or "body-loss prevention" installations with which we are concerned.

As engineers we must pay attention to the controlled cooling of the human body both winter and summer.—OSCAR N. POTIER, engineer, Lisbon, Portugal.

RADIANT HEATING AND COMFORT

F. W. HUTCHINSON'S article in the December HPAC—The Myth of the "Indoor Sun"—has certainly caused a lot of comment and controversy. It would seem from some of the comments I have heard that the article has gone as far in the opposite direction with a misconception as the author states has been the case heretofore.

My experience has been that the greatest misconception in connection with radiant heating is that coils should be in the floor because "heat rises." Nearly everyone who entertains this misconception has the idea that comfort is assured by this "heat rising" all around them. But, when the engineer states that a ceiling panel will do the job, they are baffled. Here the misconception of the "indoor sun" creeps in. No doubt the engineer is to be blamed for this, as in explaining the system the sun is a ready illustration of the phenomenon taking place.

Professor Hutchinson begins his article by stating that "We are all aware that comfortable warmth can be experienced outdoors on a cold, clear day provided one stays in the sun." I have observed this many times, but it seems to me that the term "comfortable warmth" should be changed to "greatly reduced discomfort," the degree of reduced discomfort depending on several factors, such as the temperature of surface in contact with the feet, the wind velocity, and temperature of other surfaces surrounding his body.

If engineers and heating contractors have acquired the misconception of the "indoor sun," then perhaps it has been for lack of study and thinking. In the past four or five years there have been numerous books, articles and pamphlets published on radiant heating. Many of them have used the heat from the sun to illustrate radiant panel heating. If our engineers and contractors stopped there it has been unfortunate, because almost without exception too, these publications have gone on to explain what radiant heating is designed to do.

It would appear that real comfort from the sun, as well as from radiant heating, is not through direct radiation to the body, but rather through heating surfaces which surround the body. These in turn reduce the heat losses to normal, or nearly so. It may be exhilarating occasionally to sit in direct sunlight, just as it is to sit directly in front of an open fire, but this could hardly be called comfort. Radiant heating systems should be designed not only to hold the body heat loss to the proper level for comfort, but also to have these losses occur as evenly as possible over the entire surface of the body. Not "comfortable warmth," but warm comfort, is the aim.—RUSSELL W. UPHAM, General Heating & Cooling Co.

STORAGE AIR CONDITIONING FOR BIG CHURCH

IN MY ARTICLE on the storage air conditioning system for the First Methodist church, Dallas, published in the February HPAC, there is a table showing a summary of heat gain calculations on page 74. In the first line of this table, the total load should be shown as 1,925,900 instead of 926,400, which was a typographical error. I am very sorry this error occurred.

In the same table, the total loads of the auxiliary banquet and south Sunday school rooms and the Texas room and west Sunday school rooms are incorrect as these totals, in all cases, should check exactly with the sum of the component heat gains. We had made minor revisions in the internal heat gains and, unfortunately, did not cross check with the old totals.

Regarding the basis for obtaining the internal sensible and internal latent heat gains, about which I have been asked, these figures in the table will not check with the assumed heat gain of the people as they include other factors. In my calculations, I assumed a sensible heat gain of the occupants of 220 Btu per hr per person and a latent heat gain of 175 Btu per hr per person as they are normally at rest during the Sunday services. The internal sensible total includes, of course, conduction, sun effect, and lighting; therefore, there is no direct relation between internal sensible and number of people. The internal latent load is largely from the occupants but because these rooms are used occasionally for banquets, I added an additional latent heat load for this type of occupancy.

It was indicated at the end of the article that T. E. Freeman, who is the building manager and chief engineer, assisted in preparing the article. Actually, he is the co-author and his name should appear in the byline.—DAVID C. PFEIFFER, consulting engineer.

WANTS TO DISTRIBUTE COPIES

IN THE DECEMBER HPAC, the article entitled The Myth of the "Indoor Sun," by F. W. Hutchinson, interested us greatly. This article is so informative and dispels so many misconceptions about panel heating that we feel it should be a reading "must" for everyone in the industry.

We would like to distribute several copies of this article to our branch offices.—J. FRANK O'NEILL, assistant chief engineer, Trane Co. of Canada, Ltd.

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● Revere Red-Brass Pipe has been used for many years in residential, industrial, commercial, institutional and municipal construction. It is highly resistant to corrosion and can be used where relatively high velocities exist.

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Revere also provides Copper Water Tube for use with solder or compression fittings; type B Copper Tube, for installations requiring outside diameters of SPS pipe and brazed fittings; and Copper Pipe for use with threaded fittings. Every length of Revere pipe and tube is marked with the name Revere. Look for this mark as your assurance of top quality.

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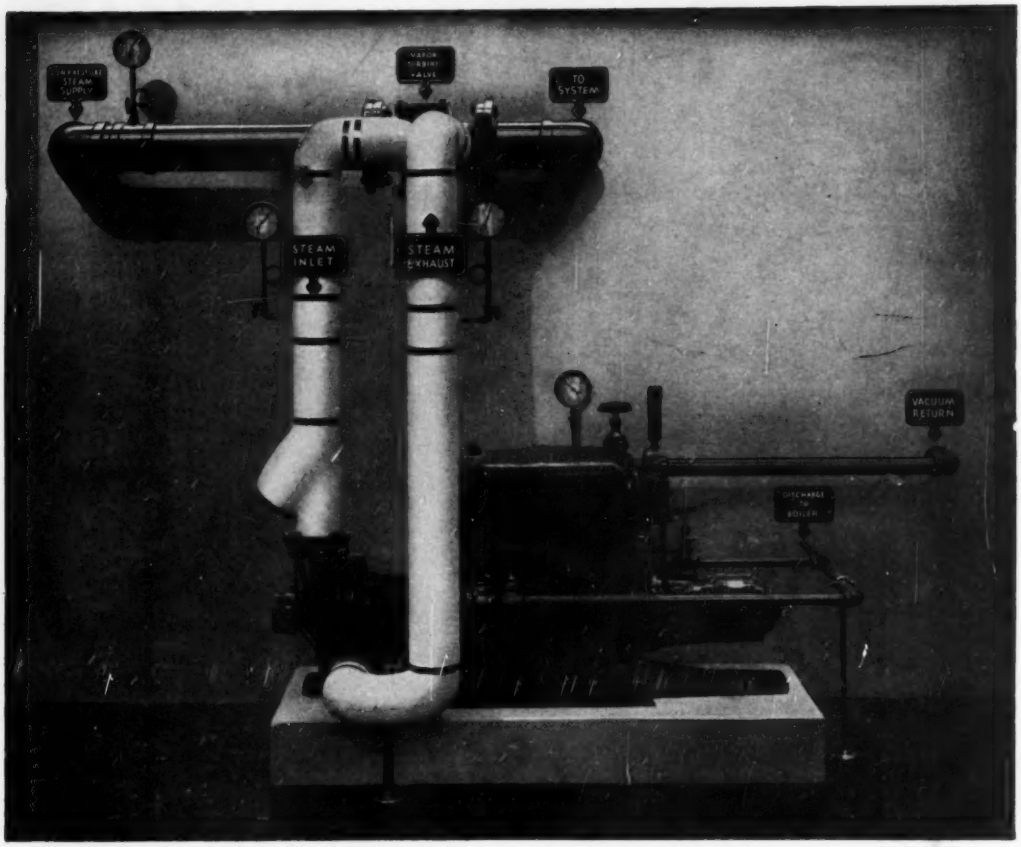
Interrupted Electric Service will not stop this NASH Heating Pump



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

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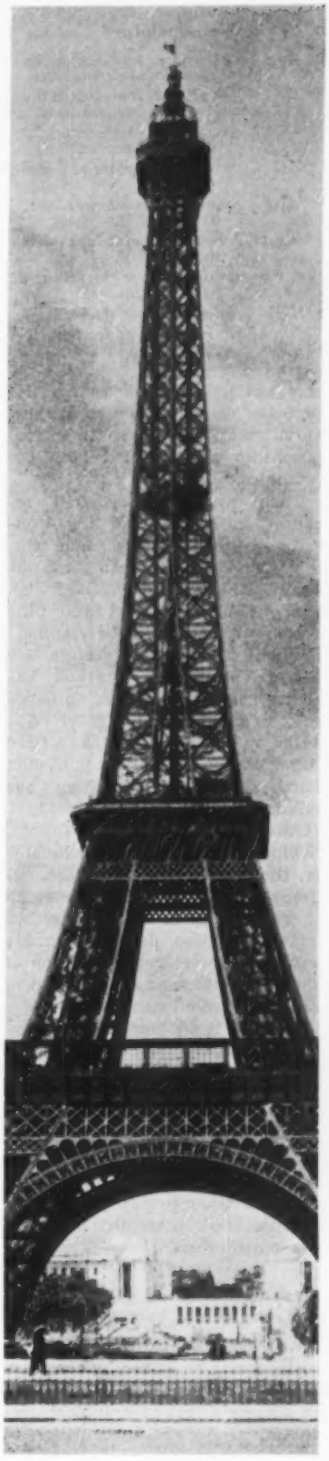
Eiffel's Logarithmic Vectors Solve

PIPING FLOW PROBLEMS

W. R. BURROWS, assistant chief engineer, Whiting refinery, Standard Oil Co. (Indiana), describes the general procedure of constructing charts with Eiffel's logarithmic vectors. The method will be illustrated and amplified in a second article by using it to obtain a graphical solution of the specific problem of the steady flow of liquids in horizontal, completely filled, steel pipes. Calculations for the construction of this liquid flow chart are given in full, and the chart itself is suitably presented for engineering use. Sufficient information, details, examples, and suggestions are supplied to enable engineers to construct workable graphs of this type. Insofar as the author has been able to determine, this article is the only presentation of Eiffel's logarithmic method written in English



ALEXANDRE GUSTAVE EIFFEL lived 91 years. In the early and middle parts of his life he produced as an engineer a succession of notable structures culminating in the spectacular tower he erected on the Champ de Mars in Paris at the age of 58. But these successes were not enough. High above the Seine he had sensed the wind and had divined its significance. So he turned to research in aerodynamics, and with undiminished power finished his brilliant and colorful life in his laboratory at Auteuil. In his 81st year he published an exposition of the graphical method discussed here [see Nouvelles Recherches sur la Résistance de l'Air et l'Aviation, by G. Eiffel. (H. Dunod and E. Pinat, publishers, Paris, 1914, p. 309 in text and plate 39 in atlas)].

Eiffel and his staff at the laboratory had determined through dimensional analysis that their experimental data on airplane propellers could be recorded in the form of a single, simple curve for each kind or design of propeller studied. These curves, plotted in rectangular coordinates, related dimensionless group abscissa values of propulsion velocity, rpm, and propeller diameter with dimensionless group ordinate values of hp, rpm, and propeller diameter. Obviously, values in addition to the original data could be obtained directly from the experimental curves either for propulsion velocity or for horsepower, because neither of these two variables appeared more than once in the relationship. But

Nomenclature

U = variable represented by scale on horizontal axis.
V = variable represented by scale on vertical axis.
W = variable represented by system of curves.
$Z_1, Z_2 \ldots$ = variable factors of U and of V.
$a,b,c \ldots$ = exponents of variable factors of U.
$A,B,C \ldots$ = exponents of variable factors of V.
m,n = uniform or logarithmic scale factors.
$K_1, K_2 \ldots$ = construction factors.
Log = logarithm to the base 10.

this was not true for rpm or for propeller diameter as each of these variables appeared twice in the relationship and affected both coordinates.

Their evaluation required recourse to an indirect, trial-and-error process. To overcome this difficulty, Eiffel searched for a direct solution equally effective for all the variables involved, and ultimately attained it in the graphical method of logarithmic vectors [see Resumé Principaux Travaux Exécutés Pendant la Guerre au Laboratoire Aérodynamique Eiffel 1915-1918, by G. Eiffel. (Librairie Aéronautique, E. Chiron, publisher, Paris, 1919, p. 95) and Etudes sur l'Hélices Aérienne, by G. Eiffel. (Librairie Aéronautique, E. Chiron, publisher, Paris, 1921)]. Fortunately, the scope of this approach exceeds that of the problem for which it was developed. The process has wide application, and is admirably suited for the graphical solution of the individual variables involved in all similar relationships.

For the most part, Eiffel's particular graphical procedure appears to have escaped notice in this country. It seems certain that if the method were better known to the American engineer, he would find it expedient and profitable to apply the scheme, where it is applicable, either to new problems or to those now presented in a less convenient form.

Graphical Method of Logarithmic Vectors

An understanding of Eiffel's method may be gained by considering it as an extended development of simpler forms of graphical presentation. A familiar depiction of engineering information is illustrated in Fig. 1, where U is represented by a uniform scale on the horizontal axis, V by a uniform scale on the vertical axis, and W by a family of curves. The relationship among the three variables U, V and W can be expressed mathematically by

$$F(U,V,W) = 0 \quad \ldots\ldots [1]$$

The graphical representation is possible whether the relationship is known mathematically or empirically. The scales for U and V, although uniform, need not be the same length per unit, but can be adjusted through scale construction factors m and n as shown in Fig. 1 where, for convenience, a definite formula $V = U^{-0.5}W$ is plotted as an example. The dotted lines in Fig. 1

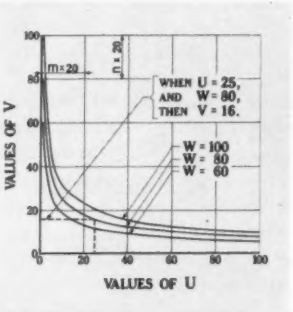


Fig. 1—Graphical representation of a relationship among three variables (U, V and W) plotted in Cartesian coordinates with uniform scales

show a particular result of this relationship: $V = 16$ when $U = 25$ and $W = 80$.

Under certain conditions it is possible, and sometimes advisable, to replace the uniform scales for U and V by logarithmic scales. This is done in Fig. 2 where the curves of Fig. 1 are reproduced in logarithmic coordinates with the origin of coordinates at $U = V = 1$. Clearly, in this particular case, a better pictorial result is obtained (and this improvement is not unusual). Again scale or construction factors m and n are introduced, but they now represent logarithmic cycle lengths, and are therefore not exactly the same as the m and n employed in Fig. 1.

These are all very familiar results, well-known to every engineer. They are repeated to show their close relationship to Eiffel's method. For it is evident that the results shown either in Fig. 1 or in Fig. 2 will not be changed if U and V are assumed to be composed of products of other variables Z:

$$U = Z_1 Z_2^a Z_3^b \ldots\ldots [2]$$

$$V = Z_2 Z_3^A Z_4^B \ldots\ldots [3]$$

But, for reasons that will be apparent, this is merely implied for Fig. 1 and is shown only for the logarithmic presentation of Fig. 2, as illustrated in the example of Fig. 3, where

$$U = 3.125\ (2)^{0.5}\ (4)^{1.25} = 25$$

then $V = 16 = Z_2\ (2)^{1.5}\ (4)^{0.25} = 4Z_2$

and $Z_2 = 4$

Hence, if the values of all Z's except Z_2 are known, Z_2 can be obtained by a direct procedure. Likewise, for example, if

$$V = 4\ (2)^{1.5}\ (4)^{0.25} = 16$$

then $U = 25 = Z_1\ (2)^{0.5}\ (4)^{1.25} = 8Z_1$

and $Z_1 = 3.125$

so that Z_1 can be determined by direct computation in the same fashion as Z_2. However, it should be obvious that no direct calculation of this type will determine Z_3 or Z_4 because each appears in the expressions for both U and V. But if the values of all the Z's except Z_3 are known, Z_3 might be estimated to be 1.9. Then, in the example:

$$U = 3.125\ (1.9)^{0.5}\ (4)^{1.25} = 24.37$$

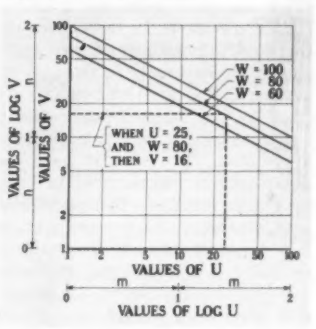
and, from the curve,

$$V = 16.206 = 4\ Z_3^{1.5}\ (4)^{0.25}$$

so that $Z_3 = 2.017$

Thus, two different values of Z_3 are obtained, 1.9 and 2.017, and their difference indicates that several more trial-and-error attempts would have to be made to obtain a

Fig. 2—Graphical representation of the relationship of Fig. 1, plotted in logarithmic coordinates



reasonably accurate value of Z_3 (known in this case to be 2).

However, it will be observed in the example shown in Fig. 3 that logarithmic coordinates are used, and for a definite reason. Note that

$$\text{Log } U = \text{Log } 3.125 + 0.5 \text{ Log } 2 + 1.25 \text{ Log } 4$$
$$= \text{Log } 25$$

Hence the abscissa 25 could be located by the sum of three horizontal vectors (Log 3.125, 0.5 Log 2, 1.25 Log 4) representing three particular values of the variables Z_1, Z_3 and Z_4. In the same manner

$$\text{Log } V = \text{Log } 4 + 1.5 \text{ Log } 2 + 0.25 \text{ Log } 4$$
$$= \text{Log } 16$$

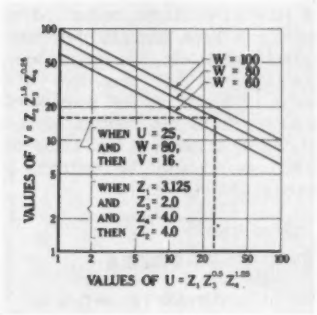

W = 100
W = 80
W = 60
WHEN U = 25,
AND W = 80,
THEN V = 16.
WHEN Z1 = 3.125
AND Z3 = 2.0
AND Z4 = 4.0
THEN Z2 = 4.0
VALUES OF V = Z1 Z2^1.5 Z3^0.5 Z4^1.25
VALUES OF U = Z1 Z3^0.5 Z4^1.25

Fig. 3—Usual graphical representation of the relationship of Fig. 1, or Fig. 2, when U and V are, in turn, functions of a number of variables Z

and the ordinate 16 could be located by the sum of three vertical vectors (Log 4, 1.5 Log 2, 0.25 Log 4) representing a particular value of the variable Z_2 and the re-use of the particular values of the variables Z_3 and Z_4.

Now, as shown in Fig. 4, two vectors (one parallel to each axis) obtain for the particular values of each of the variables Z_3 and Z_4, but the two vectors for Z_2 can be combined into one resultant vector for Z_3, and the same can be done for Z_4. Thus, a single vector can be made to represent a particular, consistent value of each of the four variables Z_1, Z_2, Z_3 and Z_4, and the sum of these vectors connects the origin of logarithmic coordinates with the point $U = 25$ and $V = 16$ on the curve $W = 80$.

It will be observed that the angles between these vectors and the coordinate axes are entirely independent of length or sense. The angle is governed wholly by scale factors and exponents. For Z_3, for example, the angle is established by: Slope $= (nA/ma)$.

Also, a vector sum is independent of the sequence in which the vectors are drawn. Hence, for any number of variables Z in the relationship, the direction of each is known. Then, if particular values are assumed for every variable except one, it too can be determined by noting the distance and sense, in its known direction, between the end of the constructed vector sum, of the variables with assumed values, and the curve representing the particular value of W for which the value of the unknown variable is desired.

This, then, is Eiffel's method for the graphical solution of Equation [1] where U is as given in Equation [2] and V is as given in Equation [3]. When the curves W are empirical functions of U and V, it is clear that the method can be made as accurate as the data involved.

Construction Details Explained

Now that the principles of the method have been described, the details of actual construction can be amplified. The curves for W are first drawn in logarithmic coordinates with a horizontal logarithmic cycle length m and a vertical cycle length n. Each variable Z is then represented by a logarithmic scale having a slope and a cycle length as shown in Table 1. The algebraic signs of a and A, b and B, etc., determine the quadrant into which the increasing scale extends from its origin at $Z = 1$ (Log $Z = 0$). These results are shown in Fig. 5,

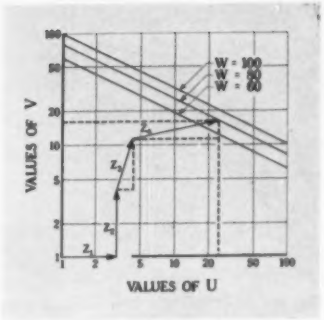


Fig. 4—Graphical representation of Fig. 3 with particular values of the variables Z shown as vectors

which continues the presentation of Fig. 4.

This is the basic method, and it will suffice to obtain solutions. However, every constructor of graphical charts knows the advantage of having as many scale or construction factors as possible to improve chart arrangements and organization. In the preceding description, only m and n have been added to vary the logarithmic cycle lengths of U and V, respectively. Additional construction factors K_1, K_2, etc., can be introduced as follows:

$$U = \frac{(Z_1 K_1)\ (Z_2 K_2)^a (Z_4 K_4)^b}{K_1\ K_2^a\ K_4^b} \quad [4]$$

Fig. 5—Graphical scales for the general solution of the particular arrangement shown in Fig. 4

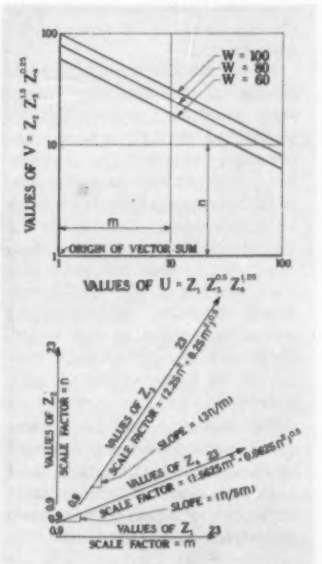

W = 100
W = 80
W = 60
VALUES OF V = Z1 Z2^1.5 Z3^0.5 Z4^1.25
ORIGIN OF VECTOR SUM
VALUES OF U = Z1 Z3^0.5 Z4^1.25
VALUES OF Z1
SCALE FACTOR = n
SLOPE = (3n/m)
VALUES OF Z3
SCALE FACTOR = (1.5625m²)^0.5 = 0.8625m^0.5
SLOPE = (n/8m)
VALUES OF Z4
SCALE FACTOR = m

Table 1—Vector slopes and cycle lengths

Variable	Slope	Logarithmic cycle length
Z_1	Zero	m
Z_2	Infinite	n
Z_3	(nA/ma)	$(m^2 a^2 + n^2 A^2)^{0.5}$
Z_4	(nB/mb)	$(m^2 b^2 + n^2 B^2)^{0.5}$
Z_5	(nC/mc)	$(m^2 c^2 + n^2 C^2)^{0.5}$
.....	.....	.....

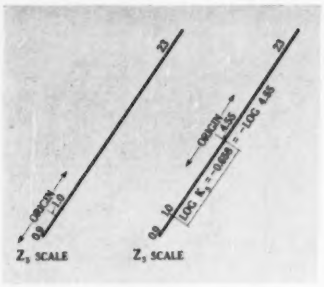


Fig. 6—Scale for Z_3, with normal origin at $Z_3 = 1$, and with origin shifted to $Z_3 = 4.55$ to locate origin near middle of scale

$$V = \frac{(Z_2 K_2)\ (Z_3 K_3)^A\ (Z_4 K_4)^B}{K_2\ K_2^A\ K_3^B} \quad [5]$$

These factors K can be used to shift either the origin of individual scales for the variables Z, or the chart origin, the point where the construction of the vector sum is initiated.

If the working range for any variable Z calls for an unusually long scale, and the normal origin is at or near one end of the scale, then an unusually long working vector will have to be drawn when large values of this particular Z are involved. Such long vectors may be reduced in length as much as one-half if the origin of the scale is moved from its end position to one near the scale center. A proper choice of the working factors K usually will accomplish this desirable change, as illustrated in Fig. 6.

It is possible that in certain charts under consideration, the curves W will lie at a considerable distance above and to the right of the normal origin of coordinates, $U = V = 1$. In such cases, if the curves W are drawn to extend throughout the entire space planned for the chart, the normal origin will be outside the chart. In order to shift this origin back into the chart, or to shift it for other reasons, recourse again may be had to the working factors K to effect the required translation. Such a procedure is shown in Fig. 7.

The principles and construction of Eiffel's logarithmic vector charts have now been formally described rather completely. But further amplification of the procedure will occur naturally in the process of applying it to the solution of the particular problem of liquid flow in pipe lines. This will be treated in a second article.

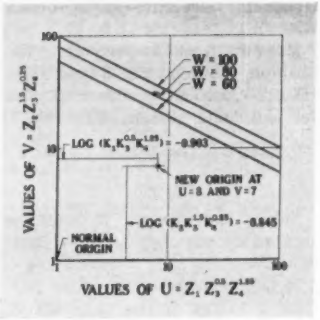


Fig. 7—Normal origin of vector sum relocated by assignment of proper values to working factors K

Convectors for One Pipe Hot Water Systems

ALTHOUGH ONE PIPE hot water heating systems are widely and successfully used, there still exists among some engineers the idea that the resistance through nonferrous convectors is so high that they will not work efficiently in such systems, according to the Convector Manufacturers Association.

An excellent illustration of the fallacy of this idea is a nine-story apartment project built in Milwaukee in 1940, says the association. This building is somewhat unusual both in design and in its heating system. It contains 55 apartments. Heating is by forced circulation hot water with separate one pipe hot water circuits to each of the apartments. These separate circuits serve several convectors in each apartment and are individually controlled by a thermostat in each apartment.

The building has been completely occupied since it has been in operation. In that time, tenants have reported uniform temperatures, accurate control, quiet operation and cleanliness. In comparison with other buildings operated by the same company, fuel costs are low, and the individual control feature has helped to rent apartments, it is reported.

Another example of successful use of nonferrous convectors on one pipe hot water is the Altgeld Garden project, Chicago, where 8500 convectors are connected to the forced one pipe hot water system. This project comprises 1500 apartments.

A nine story apartment project in Milwaukee, built in 1940, is heated by forced circulation hot water with separate one pipe circuits to each of the 55 apartments. The separate circuits serve several convectors in each apartment

How Air Conditioning Was Designed for

MUNICIPAL COURTS BUILDING

L. PORSE and E. E. GOULD, chief mechanical engineer and assistant chief mechanical engineer, respectively, with Albert C. Martin and Associates, architects and engineers, describe the air conditioning for the five-story Los Angeles municipal courts building. The design features individual room control, with the air conditioning equipment occupying no floor space. . . . Their discussion stresses the problem of air conditioning system selection to fit the particular building and its "space-economics," and describes an "air conditioning systems evaluation chart"

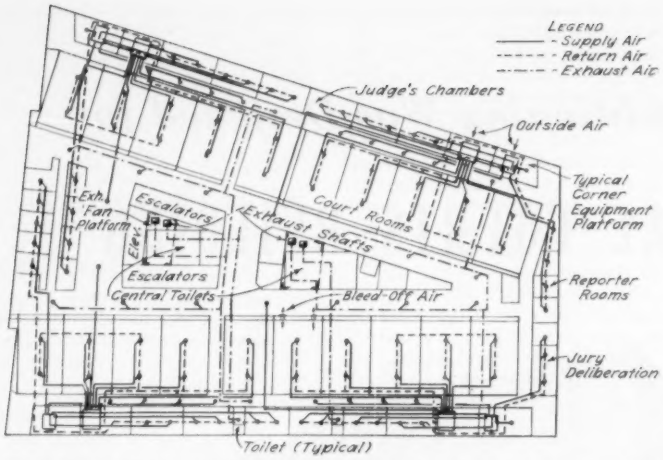
IN A BUILDING project, the architect and the mechanical engineer must contend with the perennial "space-economics" problem—from initial arrangement of the space to suit the client to the incorporation of the mechanical systems. The air conditioning engineer's main role, then, is to design an efficient system within the space limitations.

The design for the five-story Los Angeles municipal courts building calls for a year-around air conditioning system with individual room comfort control for a total of 2,200,000 cu ft of treated space. The typical floor, of about 50,000 sq ft, has high ceiling interior courts, leaving insufficient centralized space for air intake shafts and mechanical equipment rooms. Interior structural framing with deep transverse girders reduce clearances in furred space to less than 1 ft, making longitudinal duct runs very difficult. In addition, the requirements for complete privacy for courts, judges' chambers and executive offices, preclude exhausting the equivalent of the make-up air through louvered doors or wall grilles.

The arrangement of the rooms on the upper two floors comprises lower-ceiling judges' chambers, reporters' rooms, and jury deliberation rooms on the building perimeter zones and bounded by a private corridor. The interior space is allocated to high-ceiling jury and civil trial courts with adjacent witness, detention and jury deliberation rooms.

Most of the perimeter and interior space of the lower two floors is devoted to large traffic, clerical, bookkeeping, and marshal's office areas of medium ceiling heights. The remaining interior space contains the several large general arraignment and traffic courts and associated offices.

The central triangular space, bounded by two main corridors,



Third floor schematic plan showing arrangement of rooms and duct routing with combination supply and return ceiling air diffusers

contains the elevators and escalators, janitor storage, and central public toilet rooms. The basement (which is above grade on one main face of the building) contains large file and storage areas, the compressor and machinery room, and transformer vault, with the central triangular area allocated to janitor and building maintenance personnel lockers, toilets and supplies.

Air Conditioning Evaluation Chart

An air conditioning systems evaluation chart was included in a preliminary space and systems analysis report for the county's chief mechanical engineer. This method of analysis provided an impartial means of comparing systems and selecting a quality performance system best adapted to the building space, the operating factors, and the allowable installed costs. The numerical values used were arbitrary, being comparative only in terms of the design criteria for this building. Furthermore, the separate factors were weighed in accordance with their importance.

A blank form of this chart is reproduced herewith. In the upper left corner are shown the arbitrary numerical values which were used —100 for meeting the requirements "very good," 75 for "satisfactory," 50 for "fair," and 25 for "inadequate." One of these numerical values was entered for each of the items listed in the left column of the upper part of the chart for each of the five air conditioning systems. These values were totaled on the line "main performance" and, on the basis of these totals, the "performance rating" (1, 2, 3, etc.) was assigned for each system.

A similar procedure was followed on the bottom half of the chart for the building operational factors, and the columns were totaled on the line marked "sub-total." These figures were added to the "main performance" totals above to fill in the line marked "total score of system." The last line of the chart was then filled in with the "comparative ratings" (1, 2, 3, etc.) on the basis of the total score.

The usual structural, architectural and occupancy data were collected for calculating room heat losses and gains. To simplify transmission calculations, all exterior walls were reduced to several variable overall *U* factors (heat flow in Btu per hr per sq ft per deg) by use of a panel area or module system. Excess solar heat gains were totaled separately for ease in extracting the maximum peak load. Room sensible heat factors were separately determined and zones with large heat gains or high percentages of latent heat were checked for the need of reheat.

Coil cooling and dehumidification performance range were plotted on a psychrometric chart, particularly for critical exterior and interior zones, and for partial load conditions. The lowest apparatus dew point and minimum coil rows were then established from these data.

Room air change rates for exterior zones were primarily determined for a maximum room air entering temperature differential of 20 deg for cooling, as well as for the sensible heat to be removed and the occupancy factors. Interior zone courts, where no smoking will be permitted, were chiefly based on a maximum of 8.5 to 9.0 air changes per hour to assure a proper rate of air motion. Outdoor air make-up was based on occupancy factors, with a minimum 20 percent of total supply air for exterior zones and an average of 30 percent for interior.

Separate summary sheets for room air requirements and room air balance summaries were prepared for each floor to facilitate design load auditing, final equipment selection, and layout and sizing of ductwork. As a further aid to duct layout a selection table of duct sizes was prepared for varying air volumes on the chosen equal friction loss allowance, together with the proper size of supply air taps for the required size supply and return diffusers.

Following the completion of room Btu calculation of heating and cooling loads, the rooms were grouped for similar zoning, directness of duct routing, and their total required air volume to fall within an economical operating range of a standard conditioner unit. Units were usually selected for about 75 to 90 percent of their listed fan maximum delivery rate, in order to provide a safety margin and to keep air velocities through coils and noise at reasonable levels.

A building summary sheet established the total coil loads for heating and cooling, including heat gains from fans, escalator motors, return air duct heat gains in the attic spaces, and piping losses. The conditioner coil heating values and chilled water requirements were grouped vertically to correspond to the corner risers serving the units for ease in sizing the changes in pipe riser capacities at branch runouts. Internal and external zones were separated so that partial loads for building skin treatment could be computed. Building internal heat gains from people, lights and equipment were also segregated to establish the building use factor in arriving at the total cooling load.

A reduction of about 25 tons of refrigeration was accomplished by designing ducted exhaust ventilation of the escalator machinery pits to the central building exhaust fan system.

Final Design Loads

The final calculated design loads of 600 tons of refrigeration, 7000 lb per hr of steam (including warm-up factor), and 242,000 cfm of conditioned supply air were based on the following criteria:

a) Heating—outside 35 F, inside 70 F.
b) Cooling—outside 90 F DB, 70 F WB; inside 75 F DB, 61 F WB.
c) Cooling tower performance based on 90 to 80 F cooling range at 72 F WB for extreme days.
d) Relative humidity—45 to 55 percent, depending on room latent heat gains.
e) No provisions for winter humidification.
f) Effective temperature, 69.5 F.
g) Minimum chilled water design temperature, 45 F.
h) Minimum apparatus dewpoint, 49.5 F.
i) No preheating of air during winter or reheat for summer.

The final sizing of compressors—two units of 292 tons each—was based on the condensers and cooling tower having ample capacity, even when the outside air is at 72 F WB instead of the design condition of 70 F WB. This provides a safety margin of about 7 percent. The "Freon" centrifugal compressor sets selected have an added margin of 3 percent in their nominal job rating of about 300 tons each.

Salient features of the mechanical design include:

a) "Imported" 125 psig steam reduced to 10 psig low pressure steam for distribution.
b) Chilled water circulation with constant flow, modulated at coils.
c) "Push-through" type air conditioning units with high velocity filters.
d) No separate return air fans.
e) Fixed ratio dampers for outside and return air.
f) Combination supply and return air ceiling diffusers.
g) Separate toilet and building exhaust systems for half-sections of each floor.

The Method Selected

The general schematic view of the air conditioning system reproduced herewith shows the corner equipment platforms located over the lower ceiling exterior rooms, readily accessible from the intermediate landings of corner stairways. There are two air conditioning units on each platform serving a quadrant of every floor; one unit supplies the exterior zones, the other the interior zones.

The building air distribution pattern simulates an induced draft cooling tower, with air taken in at the wall perimeter and exhausted centrally through the roof. All piping for heating, cooling and controls, from the compressor room pipe mains in the basement and the risers adjacent to the corner platforms, are sized for two additional future stories.

The basement is separately heated and ventilated by six heating and ventilating units handling 50,000 cfm, with full ventilation during intermediate seasons. The compressor room and transformer vault have a separate ventilation and exhaust system.

As shown in the floor plan, conditioned air is circulated to all rooms by separate ducts located in the attic spaces. The supply ducts have individual branch taps to the combination supply and return air ceiling diffusers, whereas the return duct is directly above the return neck inlets. The return ducts are sized for the same equal friction loss as supply ducts; however, to reduce room noise level, the velocities are not permitted to exceed 1000 fpm over room areas. The air velocity of the return and outside air at the fan is approximately 950 fpm, to prevent air intake noise from communicating to adjacent rooms.

Where means for exhausting the

An air conditioning systems evaluation chart was used to provide an impartial means of comparing and selecting a system adaptable to the building. Its use is explained in the text

PERFORMANCE FACTORS	AIR CONDITIONING SYSTEMS*				
Meets Reqmts.-Very Good = 100 Meets Reqmts.-Satisfactory = 75 Meets Reqmts.-Fair = 50 Meets Reqmts.-Inadequate = 25	Dual Duct Central Cond.	Single Duct Major Zone Cond.	Single Duct Multi-Zone Cond.[a]	Unit Room Conditioner	
				H.P. Jet Air[b]	L.P. Fan Air[c]
Temperature Control					
A. Indiv. Room Control-Summer					
B. Indiv. Room Control-Winter					
C. Heat & Cool Adj. Rooms, Simult.					
D. Min. Temp. Stratif.-Winter					
E. Heating & Cooling Range					
Humidity Control					
F. Summer-Cooling Coil Dehumid.					
G. Winter-None					
Air Distribution					
H. Room Air Movement					
**J. Complete Ventilation					
K. Recirc. Air Treatment					
MAIN PERFORMANCE					
PERFORMANCE RATING					
Building Operational Factors					
**M. Use O.A. Intermediate Seasons					
N. Min. Duct Runs & Size					
P. Odor Dilution					
Q. Recirc-Germs, Etc. Btwn. Rooms					
R. Disch. Grille Noise Level					
S. Max. Filtered Air					
T. Min. Equipment In Rooms					
U. Min. Piping Required					
V. Min. Duct Space Required					
W. Min. Equip. Room Space Reqd.					
X. All-Round Performance					
Y. Least Maintenance					
AA. Installed Cost - Minimum					
BB. Operating Cost - Minimum					
SUB - TOTAL					
TOTAL SCORE OF SYSTEM					
COMPARATIVE RATING					

NOTES: *Final selection based on zonal and occupancy analysis of each floor and weighted percent of desirable system design criteria factors.
**This performance factor deleted from requirements.

a "Push-thru" type fan unit with individual ducts supplying heating and cooling.

b Room unit without fan - does not provide 100% ventilation with outside air.

c Room unit with motorized fan - outside air direct connection or central duct.

required amount of bleed-off air is unobtainable because of the requirement of privacy (as in the judges' chambers) approximately 90 to 95 percent of the air is returned. The remaining 5 to 10 percent is exfiltrated through the windows and exhausted through adjacent private toilets. The amount permitted to exfiltrate on all exterior zones maintains the building under slight positive pressure, minimizing infiltration. In order to provide the required amount of outdoor air make-up to all rooms subject to high percentages of recirculation, one zone of the equipment supplies the private corridor and a large portion of this volume is extracted by the building exhaust fans, hence balancing the outdoor air intake.

To maintain privacy in the interior courts it was necessary to fur the walls adjacent to the main corridors and design a baffled sound trap of acoustical board so that the bleed-off air would enter low and exhaust high to the corridors. This bleed-off air provides 8 to 9 air changes per hour in the corridors and 4 min air changes in the public toilets. However, supplemental air, thermostatically controlled, is supplied to the main corridors to assure transient occupants in corridors and public toilets of moderately treated air within a few degrees of room space. Air is removed from the building through corridor ceiling inlets and toilet exhaust registers, and ducted to four central exhaust fans located on two platforms over the public toilets of each floor. Louver type fire dampers are incorporated in exhaust stacks at each floor, as well as backdraft dampers at the fan discharge connection to the stacks. Since each quadrant of every floor is separately air balanced, any one or more pieces of air conditioning equipment can be operated on independent schedules if required, thereby adjusting the operational load to conform to building occupancy variations.

Interference From Lighting Fixtures

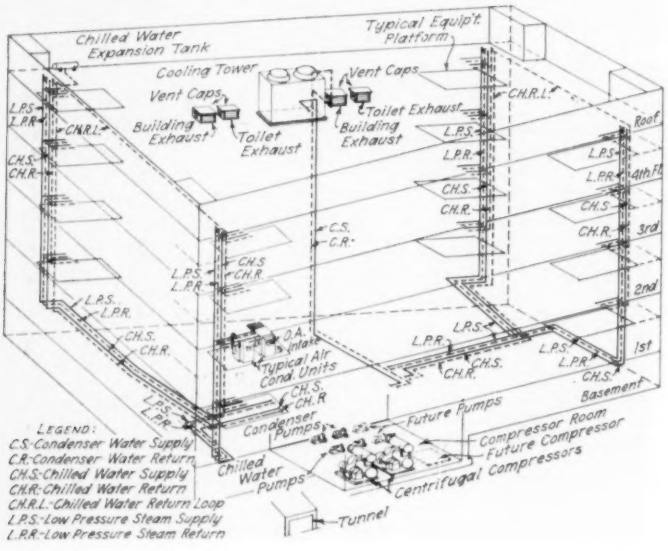
A problem in air distribution occurs when ceiling supply and return diffusers are "channeled" by surface-mounted rectangular fluorescent lighting fixtures. Since lighting fixtures often tend to compete with the desirable spacing of diffusers, or to be close to them, it is important to have accurate performance data on ceiling diffusers.

Surface-mounted lighting fixtures —depending on their depth and nearness to the air diffusers—block and deflect the air downward, which may result in downdrafts, temperature inequities, excessive air motion, dead space, or short-circuiting. Actual laboratory test results conducted by a major manufacturer of air distribution fixtures, simulating the problems encountered in this project, indicated that for comfort cooling in lower ceiling rooms the air velocities would exceed the allowable maximum of 40 fpm and a temperature differential of 1 deg. Test results were similar when diffuser cone adjustments diverted the air mass below the lighting fixtures.

A simple solution to the entire problem would be to use recessed or suspended lighting fixtures. However, since surface-mounted fixtures will be encountered, due to their lighting characteristics, appearance, savings in installation cost, or architect's choice, a careful check should be made of their effect on air distribution.

In this instance, the 12 ft ceilings in the clerical areas were the most critical for surface-mounted lights; the 9 ft, 6 in. ceilings in the exterior zones have recessed lighting fixtures. After detailed tests satisfactory performance was obtained for the 12 ft ceilings by a baffle arrangement in the diffusers, as shown in the accompanying diagram of test results.

Schematic view of the building and the air conditioning equipment, showing the routing of the piping to the equipment platforms which are located at the intermediate landings of the corner stairways

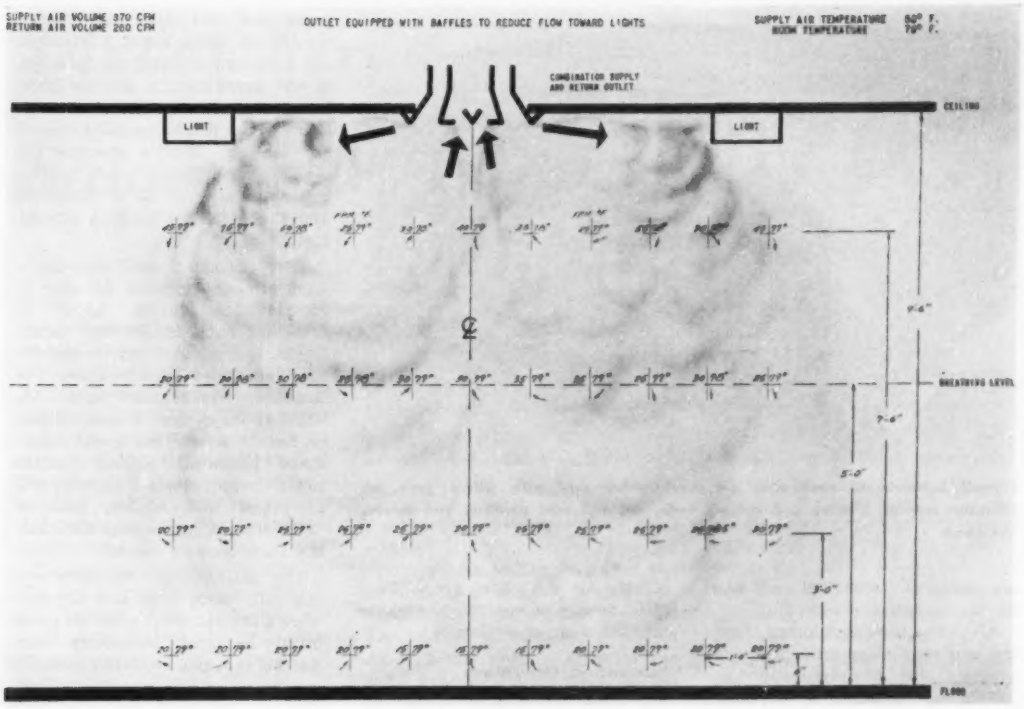


Selecting the Conditioner Units

Since transient occupancy of public courts makes up a large portion of the total cooling load, a very flexible system is required for comfort cooling. The air conditioning system must be able to cool a packed court, while delivering heated or tempered air to an adjoining office; or to air condition in whole or part a clerical floor on night schedule.

Installed cost comparisons of duct layouts for a typical floor indicated that multiple single ducts would be economical on the basis of light gages for most ductwork, and that fabricating and installing a large portion of uniform sections would reduce labor charges on final installed costs for this application.

The multi-zone air conditioning unit which was selected is a horizontal "push-through" fan type



Test results after baffling was installed in ceiling diffusers to prevent interference from lighting fixtures to air flow. Values for air motion (fpm) and temperatures are given

with an air diffusion section, vertically imposed heating and cooling coil section, humidification provisions, hot and cold plenums, built-in mixing dampers, and separate mixing chambers having horizontal and vertical discharge outlets. Damper controls are located adjacent to openings, inside or outside the casing.

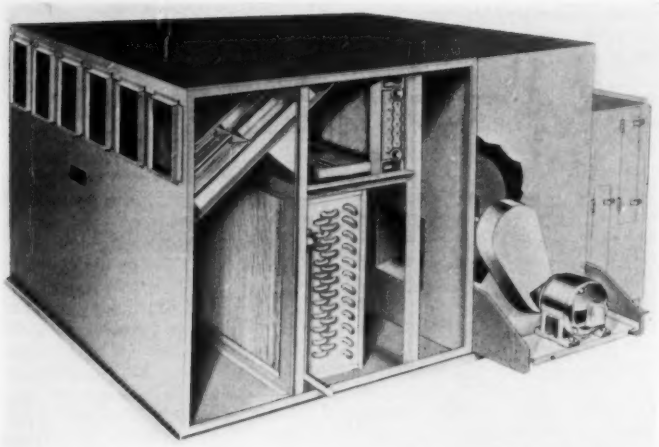
Some advantages of this unit are: (a) As many as six to 12 supply zones can be served by a single unit. (b) Maintenance, including mixing damper controls, is centralized at the apparatus. (c) As a "push-through" fan, the noise is attenuated through the coils, and this usually permits locating the unit closer to rooms served. (d) Being factory fabricated, its components should be dependable in quality of workmanship and performance. (e) Replacements and maintenance are simplified. (f) Being a standard piece of equipment, design and sizing are facilitated.

The multi-zone unit selected does not provide a bypass and reheat coil after the cooling coil. If reheat is necessary for given zones, coils can be installed downstream of the discharge openings. Furthermore, if only a few of several zones have a high latent heat it is possible that the total return air with the outdoor air intake will permit the cooling coils to adequately dehumidify within an economical performance range of the refrigeration equipment.

Most multi-zone units have forward curved fans with a maximum allowable external static pressure loss of 1 in. of water. When blocking out the zones to be supplied by a given unit, all fixed static pressure losses should be computed in advance in order to select a unit within an efficient range of its delivery capacity as well as to determine the total allowable friction loss for ductwork. The total fixed friction losses, including discharge volume dampers, supply and branch taps or necks, supply outlets, return air inlets, louver dampers and filters are subtracted from the unit's total external pressure allowance. The balance is then available for the duct system. As much as 400 equivalent feet of ductwork have been incorporated with a unit by allowing 0.12 inches of water friction loss per 100 ft and using high velocity, low resistance filters.

The sizing of discharge openings must take into account the unit size and the maximum allowable depth and number of discharge openings, which are set by the physical dimensions of the casing and mixing chambers and the minimum clearances of damper motors and ducts.

Heat is provided this building by "importing" 125 psig steam from an adjacent public building, terminating at a high pressure header in the basement machinery room. There are three pressure reducing bridges to the low pressure header. The first has a 60 percent building EDR capacity pilot type reducing valve with a full load manual bypass. The second reducer bridge is of 40 percent capacity. The third is sized for the two 680 gal hot water generation storage tanks. The low pressure mains and risers deliver 5 lb steam to the multi-zone unit steam coils. Two duplex vacu-



Typical factory-built multi-zone air conditioning unit with filters, fans, air diffusion section, heating and cooling coils, hot and cold plenum, and mixing chambers

um pumps of 15,000 EDR each handle the condensate return.

All of the air conditioning, heating and ventilating units and compressors are pneumatically controlled. A central 5 hp air compressor delivers 50 lb air to surge tanks at third floor platforms. Reduced pressure air is routed to all control points. Except for pneumatically controlled room thermostats in 190 room zones, all other controls are centered at the equipment platforms. Damper motors of each zone are controlled by room thermostats and reposition the mixing dampers.

Control of the System

The multi-zone unit controls are simple, with an outside air remote bulb master stat resetting the hot and cold plenum remote bulb submasters which modulate the steam and the three-way chilled water valves respectively. By having both hot and cold plenum temperatures reset in accordance with outside air temperature, steam and refrigeration costs are held to a minimum and mixing dampers are kept in mid-position for better response and stabilization to room thermostat demands for temperature changes. When all zones requiring heat are satisfied, the steam valve is shut off, permitting bypassing of the heating coil during complete cooling cycles. Since return and outside air quantities are a fixed ratio, no remote controls are necessary for damper setting.

Simplified Operation Stressed

Simplicity of operation and economy in maintenance is highly stressed in public building mechanical systems. Building life maintenance costs are generally considered as amounting to approximately 250 percent of the initial building costs. Hence, wherever possible, operating features were selected with the purpose of reducing maintenance budget requirements, yet making full use of the available maintenance personnel.

As an example, all filters are of the cleanable non-clog type and of the same size regardless of the size of equipment. Filter resistance gages will be installed in the filter box of a multi-zone unit at each corner of the second floor, to check when cleaning is required, which is anticipated to be three to four weeks for best results. A filter cleaning room is located in the basement with a hold rack, steam cleaning and recharging tank, drying, and storage racks with one-third reserve capacity. The filter stations are serviced by building attendants with the aid of carts and hand carriers.

Elevator machinery room penthouses are ventilated by ducting building exhaust air from the adjacent roof vent caps and re-filtering the air, using a flat filter bank and a "draw-through" fan installed in the penthouse to provide lint-free tempered air. Gravity ventilators in the penthouse roofs evacuate the air. Service charges for electrical contactors and motors will thus be kept at a minimum and life of the equipment will be increased.

All conditioner units and ductwork are service coded for ease in identification during layout of drawings, shop fabrication, installation, testing, and—above all—for the benefit of maintenance. For instance, conditioner unit No. "3SW-O" represents a unit located on the third floor, southwest equipment platform, serving outside zones. Supply ducts from this unit are coded "3SW-O-2-326," with the "2" representing the zone and "326" the room number served.

The maintenance engineer will manually start and stop all fans from a central electric starter panel in the basement machinery room. Six dial type pen recorders mounted on the panel will record the outside air dry bulb and wet bulb temperatures, and the "in" and "out" temperatures of condenser and chilled water. Condenser and chilled water pumps, located in the adjoining compressor room, and cooling tower fans will likewise be started from a panel located near the compressor units, the latter being started at their local stations.

Servicing Control Charts

All remote operational equipment will have local pushbutton stations and servicing control charts to facilitate repair and maintenance. A central air compressor will provide separate service air to all equipment platforms, and will be cross-connected to the control air compressor as an emergency standby unit.

The architectural and engineering plans—recently completed—are a joint venture of Claud Beelman with associate architect Herman Spackler designing the architectural, and Albert C. Martin and Associates, architects and engineers, designing the structural, mechanical and electrical phases. The county probably will request bids for construction by late spring of this year.

Direct Fired Heaters Replace Salamanders, Cut Heating Cost

JOHN S. WENDT, heating engineer, Dravo Corp., gives a cost comparison between modern, direct fired space heaters using gas and the old coke-burning salamanders formerly used at the Rosedale Foundry & Machine Co., Pittsburgh. After amortizing (in four years) the cost of the new installation, an annual saving of $4372 is estimated

ARE COKE-BURNING salamanders economical for heating a large industrial building? To find the answer to this question (a common one in foundries, steel mills, and other sprawling, high-roofed structures) officials of the Rosedale Foundry & Machine Co., Pittsburgh, made a detailed analysis in its plant which specializes in the production of Meehanite metal castings.

Taking into consideration the initial cost of purchasing and installing modern, large capacity, gas fired space heaters, the net annual savings, compared with the use of salamanders, amount to $402. In four years, after the new equipment has been amortized, the savings will total $4372 per year.

Financial benefit is not the only advantage of the new heating equipment—there are a number of others of equal importance, high on the list being employee health and comfort.

When salamanders were used, the foundry area was not heated uniformly and employees had to gather around fires to keep warm on cold days. Those working close to the salamanders frequently had to put up shields because too much heat radiated from the coke burners.

Excessive amounts of smoke and fumes given off by the coke fires also caused employee discomfort. They were especially troublesome for the foundry's three crane operators and windows had to be opened to relieve the concentration of smoke and fumes in the roof area. When this was done, of course, the operating area was chilled by infiltration at the working level.

Another trouble with salamanders was the hazard of upsetting them and spilling live coals over the floor. There also was the possibility of employees being burned by brushing against them.

Rosedale's 47 yr old foundry building, like other industrial structures of its type, had in the past been considered difficult to heat by any method other than salamanders. It was felt that with the uninsulated metal walls and the 48½ ft high roof in the main bay, fuel consumption would be excessive. The building is 452 ft long. The area used for foundry and machine shop work is 60 ft wide and an additional 28 ft width is occupied by a two-story section which is integral with the main plant. The second floor of this section is heated separately.

Thirty-nine coke-fired (by hand) salamanders formerly provided unsatisfactory heating in the foundry and machine shop

Cost of the Two Methods

Based on a five-month heating season, it was found that the total measurable cost of heating the foundry and machine shop with salamanders amounted to $11,134. This figure does not include such intangibles as the time lost by employees when they stopped to get warm or the production interruptions caused by frequent movement

of wheelbarrows through the working area with coke and ashes—costs which might equal or exceed measurable expenditures.

Coke used during one season in the salamanders cost $8400. To this was added $311 for unloading the coke used only for heating.

Labor needed to keep the salamanders supplied with coke and to remove ashes added up to $2423 annually.

There were 39 salamanders throughout the foundry and machine shop. These provided no heat for a small portion of the mezzanine floor where the cupolas are charged. Employees in that area had to wear heavy clothing to keep reasonably warm. Another type of heating was used for the core shop on the second floor, which is cut off by partitions from the rest of the building.

In contrast with the annual cost of $11,134 for salamander heating, analysis showed that by using four large capacity, gas fired space heaters, the cost would be $10,732 yearly —including $3970 for 25 percent annual amortization of the new equipment and initial installation expenses and $6762 for gas. After four years, when the heaters would be amortized, the annual cost would drop to $6762, or a saving of $4372 each heating season.

The calculations were based on the maximum heat loss for the building, maximum number of degree days, and keeping the plant at 60 F 24 hr daily with a 0 F outdoor temperature. Results experienced so far with the new heating system have exceeded expectations, both from the standpoints of fuel economy and providing comfortable working conditions.

Four Heaters Installed

Four gas fired heaters were installed about 80 ft apart along the north wall of the foundry and machine shop. They occupy a total area of only 150 sq ft in contrast with about 975 sq ft of space consumed by salamanders. The salamanders themselves took up a total area of 351 sq ft and the additional area represents the approximate space lost for production because of high heat radiation from the coke-burning units. Moreover, some 600 sq ft of space had been required for salamander coke storage. This has now been freed for other use.

The new heaters operate on the principle of recirculating warm air in the working zone—between the floor and about 12 ft above the floor. This tends to reduce heat losses through the roof but does not interfere with natural draft that carries away process smoke and fumes. The smoke and odorous fume problem created by salamanders has been completely eliminated. Crane operators no longer are bothered by the fumes.

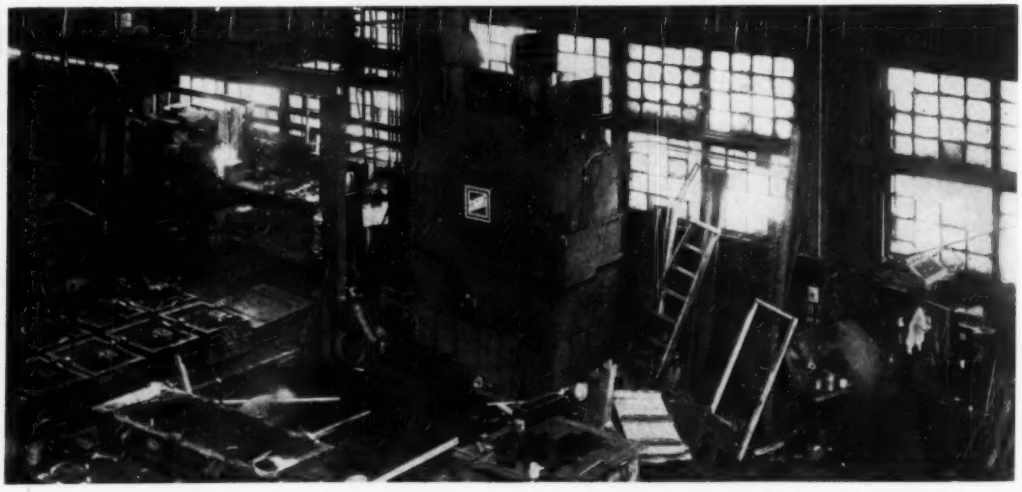
Air from floor level is pulled into the base of each heater, warmed as it sweeps the stainless steel combustion chamber and then is discharged above head height through directional nozzles.

Two of the heaters have an output of 1,750,000 Btu per hr each and the other two are 1,500,000 Btu per hr models. The larger heaters can handle 19,000 cfm of air each and the smaller ones 17,000 cfm.

Installation of the four heaters was simple. Mounted directly on the floor, they were ready for operation when fuel piping, power lines, and vent stacks had been connected.

Use of these heaters has proved not only that salamanders are more expensive to operate and maintain but that it is possible to establish comfortable temperatures economically in a foundry building without producing noxious fumes in the heating system.

Four big direct fired heaters were installed which provide better heating as well as substantial savings in fuel and labor



SOLVENT SAFETY UP TO WORKER

WHILE THE management or operator of a plant may provide all the mechanical safeguards and medical controls thus far developed to protect workers from the potential hazards of solvents, in the final analysis the safety of a worker depends upon his own cooperation, based upon an understanding of the reasons for the controls and his part in making them effective, according to the Safety Research Institute. Education toward this objective should be considered as much a part of the man's training as the proper use of his tools and equipment.

SELECTING COOLING TOWERS for Air Conditioning Service

Fig. 1—An induced draft cooling tower of the type which will cool 3 to 6 gpm per sq ft of plan area

HOWARD E. DEGLER, technical director of The Marley Co., has a great deal of industrial experience as well as consulting and research background in air conditioning, refrigeration, heat power, gas and oil engines, etc. In this timely article (water shortages are increasing the importance of conservation of air conditioning condensing water) he describes briefly and clearly the economics of cooling tower selection, choice of the proper approach temperature, and discusses other pertinent factors. He shows that often the overall cost of a cooling tower installation compares favorably with the cost of using city water

SOME YEARS AGO, the selection of water cooling equipment was considerably easier than it is today. Most plants were not as carefully designed and operated, and they were located in non-congested building areas. Some refrigeration plants built their own cooling towers by hiring a carpenter and purchasing lumber. The rule-of-thumb design of 20 years ago was to provide about 1 sq ft of plan area per gpm of water circulated and to build the unit 15 to 25 ft high. Today's spray filled, natural draft towers (12 to 18 ft high) are designed to cool 1½ to 2 gpm of water (10 F range) per sq ft of plan area with a wind velocity of 3 mph.

Induced draft cooling towers of the type shown in Fig. 1 will cool 3 to 6 gpm per sq ft of plan area. However, the correct type and size of water cooling equipment for a given service cannot be determined intelligently without considering the characteristics of the several types, together with the correlated requirement factors. Very few installations are exactly alike in their requirements; hence, conditions affecting performance and operation of the several types of water cooling equipment vary widely because of the many diversified applications and widespread geographical locations.

For a definite heat load dissipation, the type and size of a water cooling tower is primarily affected by the following conditions: gpm of cooling water; temperature of hot water entering tower at a normal rating; temperature of cold water leaving tower at normal rating; geographical location; wet bulb design temperature of ambient air [not to be exceeded more than 5 percent of the total hours, June to September inclusive, of a normal summer]; ground, roof, or substructure installation; area available; and proximity to other structures or equipment. The selection of a proper water cooling range depends upon type of service, length of service, all-year or seasonal, design wet bulb temperature of ambient air, and type of condenser employed.

Operating Conditions

Since the design of an entire plant is affected by the quantity and temperature of the cooling water supply, plants should be designed for cooling water conditions which can be most efficiently attained. The first consideration is the limiting temperature of the plant; for example, if a "Freon-12" compressor refrigerating plant is to be designed for 117 psig head pressure as a normal maximum, the limiting temperature of the refrigerant in the condenser would be 100 F. Should the refrigerant temperature or pressure go above 100 F or 117 psig, then the power consumption would increase.

To assure this continuous head pressure of 117 psig, the temperature of the circulating water leaving the condenser must always be less than 100 F by an amount depending upon the size and design of the condenser, the quantity of water being circulated, and the tons of refrigeration produced. A condenser having a large surface per ton of refrigeration may be designed to operate satisfactorily with the leaving hot water temperature within 3 to 5 deg of the refrigerant temperature corresponding to the head pressure, while a small condenser may require 10 deg difference.

Economics of Tower Selection

It is advisable to purchase water cooling equipment with ample capacity, because the higher cost of the cooling tower will effect a lower price for the refrigeration equipment, and there will be an additional saving in operating cost of the plant.

The information presented in the accompanying table is for a 100 ton "Freon" plant operating at a 40 F evaporating temperature, with a 78 F wet bulb, and with the condenser water supplied at 300 gpm. The table contains performance and cost data based upon cold water temperature approaches to wet bulb from 5 to 15 deg with increments of 2 or 3 deg, and a heat removal under all conditions of 30 gal-deg per ton per min.

Condenser selection provides a number of possible types and different amounts of cooling surface. In this article, no particular condenser was selected but the assumption was made that for *normal operating conditions*, 300 gpm and 10 F range, the temperature of the refrigerant leaving the condenser would be 5 F higher than the water leaving the condenser for each approach listed.

It has been assumed that the condensing pressure (item 5 of the table) will correspond to the temperature of the refrigerant (item 4) leaving the condenser; this is not true in practice but may be considered satisfactory for ease of comparison. With "Freon-12" plants, 1 deg difference in condensing temperature would change the pressure about 2 psi. The price of the refrigeration equipment (item 12) covers the compressor, motor, drive, electric starter, etc., delivered and erected. It is realized that this cost may vary with the different types of units, drives, auxiliaries, and location; but regardless of the equipment cost assumed, the comparative results for our purpose here would be the same.

The cost of the induced draft cooling tower, delivered and erected (item 13) includes fan, pump and piping for a complete water cooling installation. The estimated total cost of the complete installation is given in item 14 for each approach temperature to the wet bulb. It should be observed how closely these equipment costs agree; that is, it costs about the same to install the necessary refrigeration machinery with the proper cooling tower for a 5 F approach as it does for a 15 F approach to the wet bulb. This is true because of the compensating fact that the cooling tower costs more for a close approach than it does for a long approach, whereas the refrigeration equipment costs less for the close approach than for a long approach; however, more tons of refrigeration can be obtained with a close approach (see item 17).

The annual operating cost of the complete installation, refrigeration and cooling tower, is shown in item 16 which is the sum of power costs (item 10), fixed charges (item 15), and cost of make-up water (item 11). Item 17 shows the tons of refrigeration that can be produced by a given compressor for each approach without overloading the 100 hp motor. It can be seen that with a low approach (5 to 7 F) a higher tonnage can be obtained than with a 15 F approach to the wet bulb temperature of the air.

The overall operating cost per ton of refrigeration is indicated in item 18, which shows that the low approach (cooler) operation would result in a 25 percent saving over the high approach. In actual practice, this saving would probably be more than the computed values of item 18.

Repair and maintenance costs were not included in the table because they are controversial and would vary from 5 percent or less to 50 percent or more, depending upon the quality of the water, the type of equipment, the use factor, the chemical treatment, and many other factors, of which neglect contributes materially; all of this would be dependent largely upon the care and/or abuse of equipment of this kind.

In connection with the city water cost, it should be emphasized that after a year's operation on city water (once through), most systems would require more than 1½ gpm of water per ton because of the application of a "fouling factor," since the heat transfer would be reduced as scale accumulates.

Overall Selection Recommendation

From the above discussion, it is recommended that the second column in the table be chosen as an engineering basis for the economic

How cooling tower size affects operating cost of the installation (tabulated values are based on 100 ton "Freon-12" plant, 300 gpm cooling water, 10 F cooling range, 78 F wet bulb temperature)

Approach	5 F	7 F	10 F	12 F	15 F
1. Cold water from tower	83	85	88	90	93
2. Hot water to tower	93	95	98	100	103
3. Temp. diff. at condenser*	5	5	5	5	5
4. Condenser temp., F	98	100	103	105	108
5. Condenser pressure, psig	113	117	123	126	132
6. Compressor bhp	90	93	98	101	106
7. Fan (tower) hp	6	6	4	4	3
8. Pump hp (40 ft. 80%)	4	4	4	4	4
9. Total horsepower	100	103	106	109	113
10. Power cost, 1½c, 1500 hr**	$2,100	$2,160	$2,225	$2,290	$2,375
11. Water make-up, 2%†	$70	$70	$70	$70	$70
12. Refrig. equip.	$13,500	$13,950	$14,700	$15,150	$15,900
13. Cooling tower	$4,900	$4,200	$3,500	$3,250	$2,800
14. Total equip. cost	$18,400	$18,150	$18,200	$18,400	$18,700
15. Int. and depreciation, 15%	$2,760	$2,720	$2,730	$2,760	$2,810
16. Cost per year, items 15 plus 10 and 11	$4,930	$4,950	$5,025	$5,120	$5,255
17. Tons with 100 hp motor	111	107.5	102.5	99.3	94.4
18. Overall operating cost per ton	$45	$46	$49	$52	$56

City water cost, if used once through: 1½ gpm/ton at $1.00 per 1000 cu ft water = $1800 for 100 tons.

*Temperature of refrigerant from condenser *minus* temperature of water from condenser.
**May 15 to September 15, 12 hr per day.
†Includes evaporation, drift, run-off, and leaks.

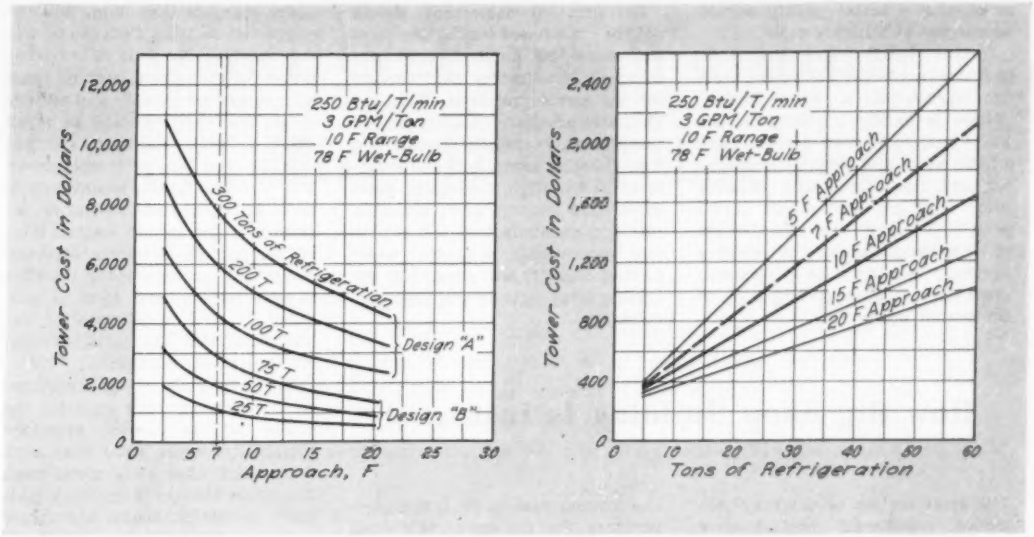


Fig. 2 *(left)*—**Tower cost increases as the desired cold water temperature "approaches" the wet bulb temperature of the air. The author's experience indicates that a 7 F approach is a good compromise value, considering overall cost and performance. Fig. 3** *(right)*—**Tower cost increases with decreasing temperature approach requirements**

selection and operation of this complete refrigeration installation. It is the best compromise from the standpoint of desired low approach, good cooling range, low first cost, low overall operating cost, and high refrigeration effect with a 100 hp motor. Higher or lower pumping rates are not desirable because of unsatisfactory operating characteristics. The possible desire for the lower approach of 5 F instead of 7 F is not warranted because of higher first cost and the few hours per year that it may be needed. This last statement will now be further explored.

Tower Cost vs Low Approach

The curves in Fig. 2 indicate tower costs for three sizes of two tower designs for various cold water temperature approaches to the wet bulb air temperature. The general conditions of operation are shown on the graph. To obtain an approach of 5 F or less requires a tower cost higher than its general need (weather and performance) requires. However, experience shows that for air conditioning applications an approach of about 7 F (for 75 to 78 F wet bulb) is a good compromise for least overall cost and high performance. For commercial refrigeration service, an approach of 10 to 12 F is generally considered sufficient, the amount depending upon the wet bulb design temperature chosen for a particular application.

A study of Fig. 3 shows that the higher the tons of refrigeration the more desirable it is to select carefully the water temperature conditions in order that the cost of the cooling tower will be reasonable and good performance for anticipated extremes of weather and operation will still be assured.

Some price-conscious persons might be tempted to specify a high approach (say 15 F based on 75 F wet bulb) to reduce materially the first cost of a water cooling tower, as indicated in Fig. 3. This would be false economy, as previously discussed in the analysis of the tabulated values. Not only would the operating costs increase but the higher water temperatures would result in increased condensing pressures and temperatures. High condensing pressures are undesirable (especially with centrifugal compressor units) because of the following possible difficulties: overload on motor; high discharge temperature may mean poor lubrication, valve troubles, and refrigerant breakdown; added wear on equipment; decreased volumetric efficiency; lowered refrigeration effect; and increased operation costs.

The total annual cost of owning a water cooling tower is often less than the cost of city water used once for cooling and then wasted; for a 100 ton installation, the yearly cost of a tower is considerably less than the city water cost when calculated at the rate assumed in the accompanying table. Amortization of the cooling tower can be effected in about three years from the savings in water costs for units of 50 tons or larger capacity; this reasoning would be even more justifiable where water rates exceed the nominal cost of $1.00 per 1000 cu ft (13c per 1000 gal), as is the case in many cities.

Low Cost Not the Only Criterion

The time-honored and practical method of writing specifications and calling for competitive bids, with complete statements of the guaranteed performance, is the best plan to obtain accurate and competitive cost data for the selection of water cooling equipment. The question will inevitably arise as to whether or not the lowest of competitive bids (on perhaps the poorest equipment) should be accepted,

or whether a better quality should be selected at a higher price.

In this regard it may be difficult to frame any better statement than the observation of John Ruskin, "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper; and the people who consider price only are this man's lawful prey." However, the effectiveness of rigid specifications and selective purchase can only be determined from the installed performance of the actual equipment.

Refrigeration equipment should not be purchased on a low cost basis alone, but for an assured continuously satisfactory performance for the service required. This necessitates adequate capacity for the compressor, evaporator, condenser, water cooling equipment and correlated items. High condensing pressures (and temperatures) generally result in unsatisfactory and expensive operation; sufficient water cooling capacity will assure low operating temperatures and good performance.

How Big Shop Building Is Insulated

THE FIRST section of a large "controlled conditions" central shop building, bearing a strong general resemblance to the huge bomber plants built at Tulsa and Fort Worth during the war years, has been completed at the Baytown, Texas, Humble Oil and Refining Co. refinery.

The building—720 ft long, 308 ft wide and with an over-all height of 45 ft, 8 in.—will bring under one roof all the refinery's repair and maintenance shops, instead of having them scattered throughout the refinery area. It will be a completely windowless structure, lighted by incandescent and mercury vapor lights, and with interior walls and ceiling designed for maximum sound deadening and light reflection.

Specifications require that during the summer months the inside temperature shall not exceed 78 F when the outside dry bulb temperature does not exceed 95 and the outside wet bulb temperature does not exceed 80. Relative humidity is not to exceed 50 percent with an outside wet bulb temperature of 80 or less. In winter, the temperature is to be maintained at a minimum of 72 when the outside dry bulb temperature is 20 or above and a relative humidity of at least 30 percent is to be maintained when the outside dry bulb temperature is 32 or above. Heat loads in various parts of the building will vary and the building will be zoned to meet this requirement.

The completed section of the building is 312 ft long by 308 ft wide. The second section, 168 ft long and the same width, is now under construction and will be completed in 1950. Construction of the third section will follow completion of the second section. Glass fiber insulation in walls and ceilings of all three sections will be relied upon to help maintain specified summer and winter temperatures. The air conditioning equipment to serve all three sections will be installed in the second section. One 550 ton and one 1100 ton centrifugal compressor are now being installed in this section, and room is provided for the installation of two additional 1100 ton units. "Freon" will be the refrigerant.

The side walls of the completed first section are built up, from the inside out, as follows: expanded metal lath, white glass fiber mat, 2 in. thick fiber glass metal-mesh insulation blanket, 2 in. thick glass fiber insulation board, corrugated asbestos siding. Ceiling construction, from the inside out, is expanded metal lath, 1 in. thick sewn glass fiber insulation blanket faced on the inner side with white cloth woven of glass fiber yarns, sisal kraft vapor barrier, 3 in. thick glass fiber insulation blanket. Above the ceiling is an air space, then precast roof slab topped by a built-up roof.

The white glass fiber mat in the walls and the white glass cloth in the ceiling are employed for light reflection and to provide a porous surface that will permit sound waves to pass through and be absorbed by the glass fiber insulation. Nearly 250,000 sq ft of glass fiber insulation, more than 30,000 sq ft of glass fiber mat, and nearly 100,000 sq ft of glass cloth are installed in the walls and ceiling of the first section alone.

Wall and ceiling construction of the second and third sections will be similar to that of the first section, but in the second section, and probably the third section, 13/16 in. glass fiber roof insulation will also be used in the roof, so that a thinner precast roof slab can be used while retaining the same over-all *U* value.

Design of the central shop project was carried out for the Humble Oil and Refining Co. by its engineering division at Baytown. The H. K. Ferguson Co. performed all detailed engineering for the first and second sections and for the air conditioning of the third section. (Photo courtesy Owens-Corning Fiberglas Corp.)

Applying ceiling insulation at first section of Humble Oil's central shop building at Baytown, Texas

Quality Pipe Welding ... How It's Achieved

E. P. EVERHARD, vice president of William A. Pope Co., heating, piping and air conditioning contractors, and chairman of the technical committee of the National Certified Pipe Welding Bureau, spoke at a recent safety conference on welded piping. This article is based on his remarks at that meeting. He points out that safe, quality welds can be made day after day on job after job, and explains some of the development work during the past years that makes this possible

WELDED PIPING is safe piping. Safe, quality welds can be made day after day and on job after job.

Quality pipe welding requires a special ability to provide a thoroughly fused joint between two pieces of pipe for the full thickness of the wall which will duplicate the chemical and metallurgical as well as the physical characteristics of each material. Obviously, the full application of such a new process did not come overnight to the piping contractor (any more than it did to other industries adopting the welding process).

Varying success was obtained by the pioneer users in the face of much misleading information. It appeared to be necessary for each contractor and manufacturer individually to provide the full mechanism for applying the process. Each user developed his own procedure and personnel and attempted to keep the secret from his competitors. This difficult condition was more or less true of the whole welding industry, but was especially confusing for the piping contractor who, traditionally, employs journeymen mechanics who travel from job to job and seldom stay continuously with any one contractor.

Because piping systems are essentially pressure vessels, piping contractors elected to follow the American Society of Mechanical Engineers boiler construction code as the yardstick in judging welding results. In doing this, we found duplication of operator testing every time these journeymen operators changed employment from one contractor to another.

Pipe Welding Bureau Born

However, along with improvement of welding machines and materials, we did succeed in stabilizing procedures and methods of application and in training and qualifying sufficient personnel so that by 1940 we were able to establish in Chicago the first group of contractors organized in the form of a Certified Pipe Welding Bureau. These contractor members agreed to conduct their welding operations under the uniform standard procedures developed by this bureau.

The original group has now grown into the National Certified Pipe Welding Bureau, with 17 chapters in various centers across the nation, 220 contractor members, and recorded tests on some 1200 qualified pipefitter welder operators.

Recognizing the benefit of avoiding duplication of qualification tests of procedure and operators, the ASME boiler code was revised in July 1948 to permit the interchange of operators between such contractors on similar pipe work using the same procedures and operators.

This bureau is open to any individuals or corporations engaged in the welding of pressure pipe who can prove to the bureau that they possess the required facilities and knowledge and will abide by the rules of the bureau and the ASME boiler construction code in the conduct and supervision of their welding operations.

While this bureau develops and qualifies basic procedures, conducts research in new methods and materials, and trains and qualifies operators available for employment by all active members, two points should be emphasized.

1) It is designed for serving the pipe welding industry only.

2) Bureau membership in no way limits or restricts any member in developing additional procedures or extending his own tests and experiments and knowledge beyond the minimum requirements of the bureau and the codes. We all know there is no substitute for individual experience and intelligence, but group activity in establishing and guiding the fundamental control and use of such a process in the building trades is, I believe, a definite contribution to the safety of the public.

We recognize that the quality of welding is the responsibility of the erecting contractor, and to this end we are continuously studying ways and means that may lead to improved quality, more consistent quality, and economies with equal quality.

We have made hundreds of test welds, studying them in many ways,

to establish standard procedures for different processes and the various metals adopted by industry to meet changing requirements.

Use of Alloy Piping

While the bulk of all piping used today is still, of course, carbon steel, alloy piping finds ever-increasing usage in power and industrial process service. The public utilities, in the race for larger outputs and greater economies in the production of electric current, have been forced to the use of alloys to support advances in pressure and temperature. Pressures have moved from 600 to 900 lb to 1250 to 1850 and 2350 lb. Total temperatures have moved in the same period from 750 to 1050 F.

Ten years ago we were using carbon molybdenum pipe for services in the 1500 lb class, but continued use of this material at temperatures of 925 to 950 F developed graphitization in the heat affected zones of welded joints after five to eight years, and it was found necessary to add chromium as an inhibitor. A new pipe material, running ½ to 1 percent chrome with ½ percent molybdenum was developed, and recent installations for 1850 lb and 1050 F use 2¼ percent chrome, 1 percent molybdenum materials. These installations serve generating units of 100,000 to 150,000 kw capacity and require what we might better call steam conduits—too large and too heavy to be made as ordinary pipe. Present pipe mills are too light to handle the combination of this material and size required as rolled pipe; it is necessary to hot forge a billet and hollow bore this to produce pipes up to 18 in. OD and with walls up to 3 in. thick.

When one considers that these pipes and valves—inside of 6 in. of high temperature insulation—are red hot throughout their entire service cycle, it is obvious that the welded joint must be reliable and safe.

Some major items which contribute to this reliability can be listed as follows:

1) Correct materials and filler metal for the service intended.

2) Adequate assembly and support—no strain on joint during the welding and heat treating operations.

3) Cleanliness of pipe and joint prior to and during welding.

4) The use of a welding technique proved by previous test and complete examination to fit requirements.

5) Adequate preheats and postheats. A bad weld cannot be corrected by heating, but proper use of heat will provide better and more uniform welds.

6) A pipefitter welder trained and qualified in the given materials with sufficient tools to support his operation.

A competent contractor who knows the requirements is able to supply all of these and give the safety desired.

In closing, I think I need only add that we as contractors welcome the inspection and consideration of welded piping given by safety organizations. The extension of such inspection by licensed inspectors to every welded system would most certainly be in the interest of public safety.

An inspector explains a test for journeymen pipefitters during a program conducted by a chapter of the National Certified Pipe Welding Bureau

ASKS ABOUT PIPING FOR OIL BURNER INSTALLATION

YOU ARE INVITED *to answer the following question. Suitable comment on the matter will be welcomed and—space permitting—will be published and paid for at regular rates. Sketches and photos are particularly desired. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

"In industrial and commercial oil burner installations, what is the accepted practice of bringing the oil from the tank to the burner? Is it a two pipe system, using one suction feed line to the burner and a return line to allow the unburned oil to return to the tank? Is anyone using a one pipe system (suction pipe only with no return) feeding a smaller amount of oil? What are the objections and advantages of such a system?"—S.G.

100% Outdoor Air System Serves Hotel Dining Room

V. W. FAWCETT, superintendent of buildings of the Commodore Perry Co., describes the new air conditioning system serving the combination dining room-cocktail lounge at the Willard hotel in Toledo. Independent control of temperature and humidity is provided, an existing 25 ton compressor cooling the air and a lithium chloride system removing moisture by chemical absorption. No air is recirculated, 100 percent outdoor air being employed to remove smoke and odors

A 100 PERCENT OUTDOOR AIR system, with independent control of both humidity and temperature, has solved an air conditioning problem in Toledo's Willard hotel. Supplying air to the Chevron room in the hotel's lower level, the system is capable of reproducing the comfortably dry climate that has made Arizona famous as a resort area.

Used as a dining room-cocktail lounge, the room measures 57 by 72 ft, has a capacity of 300 persons. The features that made the air conditioning problem difficult are the high occupancy and the very low 8 ft, 3 in. ceiling. Not only did the low ceiling height make it difficult to provide draftless distribution of air, but it allows only 113 cu ft of air space (a 5 ft cube) per person.

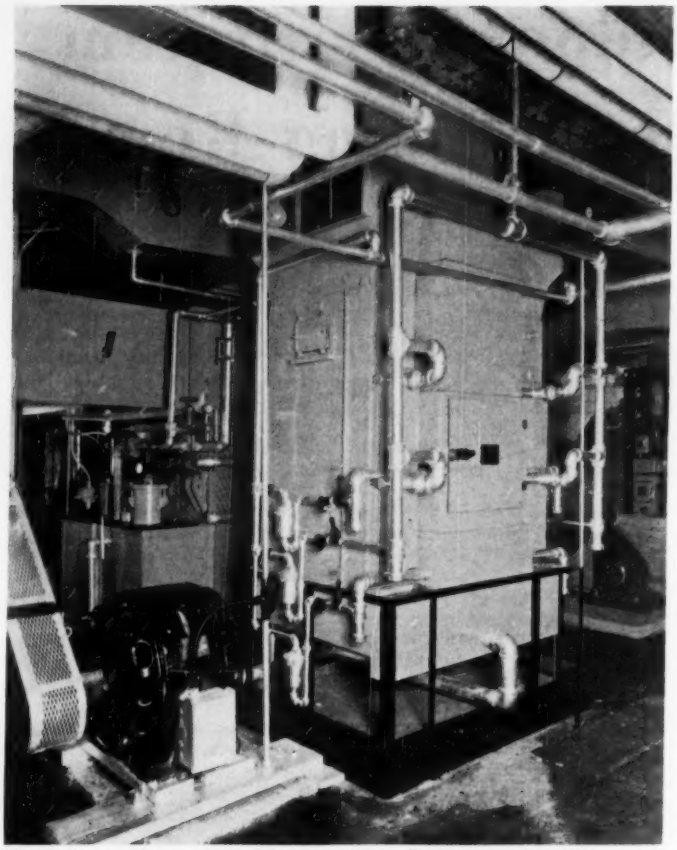
The previous conditioning installation provided for only about 10 cfm of outdoor air per person, which was entirely inadequate; smoke and odors accumulated until the atmosphere was practically unbearable. The old system circulated 8000 cfm, of which 3200 cfm, or 40 percent, was outdoor air and the remainder recirculated. The air was cooled in summer by a 25 ton compressor, but no particular attempt was made to control the humidity.

To remedy this situation, the new system was installed to carry out the smoke and odors with no recirculation. The existing compressor was retained for cooling the incoming air in summer, and a 12,500 cfm capacity humidity control system was installed to handle the moisture load. This relieves the compressor system of the latent load (moisture condensation), and enables the existing compressor to take care of the increased cooling load.

About 10,000 cfm of outdoor air—cooled, dried, and washed—is supplied to the room, resulting in a complete change of air every 3½ min and 33 cfm per person. This does not give the air time to become stale, and even with the room filled to capacity, there is never any smoke to be seen. Most of the air is not exhausted to the outside, but is used again to provide comfortable working conditions in the kitchen.

This is accomplished by directing the air exhausted from the main room through grilles which provide even air distribution throughout the kitchen. From here, it is blown to the outside. This arrangement has a twofold advantage. First, it transforms the kitchen into a dry, comfortable place in which to work. Second, and perhaps even more im-

The Chevron room's 8 ft, 3 in. ceiling and its capacity of 300 persons made a tough air conditioning problem. Behind the bandstand is the bar section of the room



The equipment for producing the dry "Arizona" air is this humidity control system. The unit in the foreground is used for continuous regeneration of the solution, and the unit in the left background is the contactor, in which the moisture level in the air is controlled

portant from the customer's point of view, is the fact that the kitchen is held at a lower pressure than the dining room, and kitchen odors cannot escape to the dining space through the much-opened kitchen doors.

The humidity control system, heart of the new installation, removes moisture by chemical absorption. It uses a solution composed largely of lithium chloride, which has a large moisture carrying capacity, is easily regenerated, leaves no odor, and has an antiseptic effect on the air.

The only moving parts of the humidity control equipment are a small circulating pump and a blower, and the only utilities required are a small amount of low pressure steam for heating the regenerator, electric power for the blower and pump, and water to keep the solution cool.

The solution does not carry over into the treated air and may be regenerated an unlimited number of times to its full strength. Since the capacity of the solution to absorb moisture varies with its temperature, it is a simple matter to control the humidity of the room by controlling the temperature at which the solution contacts the air.

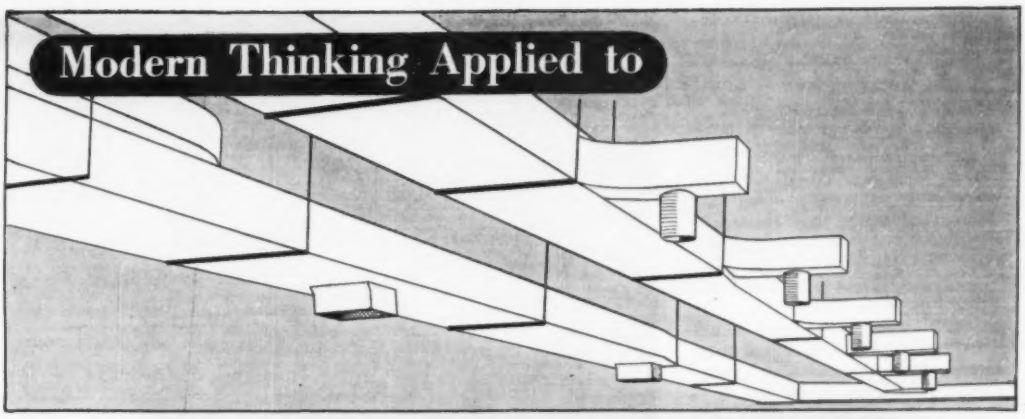
Drafts were another problem with the old system, largely because of the low ceiling height which prevented the incoming air from being brought in at a high enough level so that the air stream would not hit anyone directly. To remedy this, an acoustical ceiling was installed, leaving a small space between it and the solid ceiling. This space is used as a plenum chamber and conditioned air is "dumped" into it, from where it filters down into the room through the many small holes in the ceiling. A few grilles were also placed in this ceiling to augment the flow of air.

The air is exhausted from the room by two fans, located at its opposite ends. The smaller one, over the bar, exhausts directly to the atmosphere, while the larger one exhausts to the kitchen.

Cost Considered Reasonable

Air conditioning engineers are inclined to throw up their hands at the cost of operating a 100 percent outdoor air system. However, in this installation, costs are believed quite reasonable considering the benefits obtained. The humidity control system dries the large volume of air economically, using a 2 hp electric pump, 2½ lb of steam per lb of water removed from the air, and city water to maintain the solution temperature. This leaves only the sensible load to be carried by the mechanical refrigeration. The sensible load is low with dry air because dry air is comfortable at a higher temperature and need not be cooled so far below the outside air temperature. The only reason that it was necessary to go to the extreme of 100 percent outdoor air was that nothing short of it would do the job under the difficult conditions that existed; to install another semi-successful system in the room, with not enough air per person, would mean denying the room its normal earning power.

The Willard's manager, Mrs. Ethel M. Miller, says that she feels that the cost of the new air conditioning system has definitely been a wise investment. "With the old air conditioning," she says, "our dining room business dropped off during the summer, and the help was continually complaining about the bad air in the kitchen. Since installing the new system, our summer business is excellent, and even with the room filled to capacity there is not the slightest staleness or smoke in the air. The kitchen is now even more comfortable than our lobby during the hot months. I understand that a number of the downtown businessmen walk extra blocks in summer to enjoy our climate at lunchtime."



Modern Thinking Applied to DUCT DESIGN

KIRBY WALKER draws upon his experience in the heating and ventilating field and in wartime research and engineering to discuss duct design. A licensed professional engineer, he was engaged on heat transfer and combustion projects for two large aircraft companies during the war. He has had a wide experience in the heating and ventilating industry, and has supervised manufacturers' laboratory and development personnel

IF YOU TURN a right angle along a flow path in a duct system without streamlining, you can lose a lot in friction; *f*, the friction coefficient for shock losses, may well be in the neighborhood of 1. On the other hand, by streamlining a turn in the flow path, *f* can well be from 1/7 to ½. Furthermore, streamlining a flow path reduces the turbulence that causes noise. We are therefore, in these articles, assuming that the duct design will be streamlined.

Exhaust tees and supply tees may appear to present the same problems. Their action is, however, different. Hence, separate discussions of them are given.

Volume Regulation in Tees

A splitter used in a tee is set at a point such that the flows through the respective branches are the design values. It is not always possible to give a short run leaving a tee a high friction so that it will equal the friction on the long run connected to the same tee.

Examination of Figs. 17A and 17B shows the effect of a splitter on a supply tee. The regulation is good because the turbulence or friction imposed by the splitter occurs in the branch whose resistance we wish to increase. In Fig. 17A, by restricting at *2B*, resistance from *2B* to *3B* is increased without appreciably affecting the resistance from *1* to *2A* to *3A*.

When a splitter is used on an exhaust duct, the effect is poor regulation. You will note in Figs. 17C and 17D that the splitter creates friction affecting both circuits, since turbulence is thrown into the main stream at *3*. For this reason, it is best to use a volume damper on exhaust tees. These dampers may be in the duct approaching the tee or just in the individual exhaust registers. You can readily see that such an arrangement in Fig. *17E* raises turbulence in the branch we wish to regulate; little turbulence is created in the other circuit. In Fig. 17E, branch *1B* is the short run whose resistance would have to be increased. That explains the location of the volume damper in that branch.

Some designers use volume dampers rather than splitters in supply tees. The author feels, however, that a splitter in a supply tee would give less overall friction and prove more satisfactory.

Recommended Exhaust Tee

An exhaust tee that could be adapted to practically any situation is shown in Fig. 18. It is important to make the area at *2B* in Fig. 18A give the same velocity as that in *2A*.

In figuring the friction, it simply boils down to the friction for an ell and that for a tranformation. The friction from *1A* to *3* includes the

transformation; from *1B* to *3* it includes the ell plus the transformation. At *2A* and *2B* you have open end static; their static pressures are equal. Since you make velocities equal by proportioning *2B*, their total pressures are the same. A splitter should not be used in the tee but volume dampers should be shown upstream. Any type ell may be used, depending on circumstances.

Recommended Supply Tee

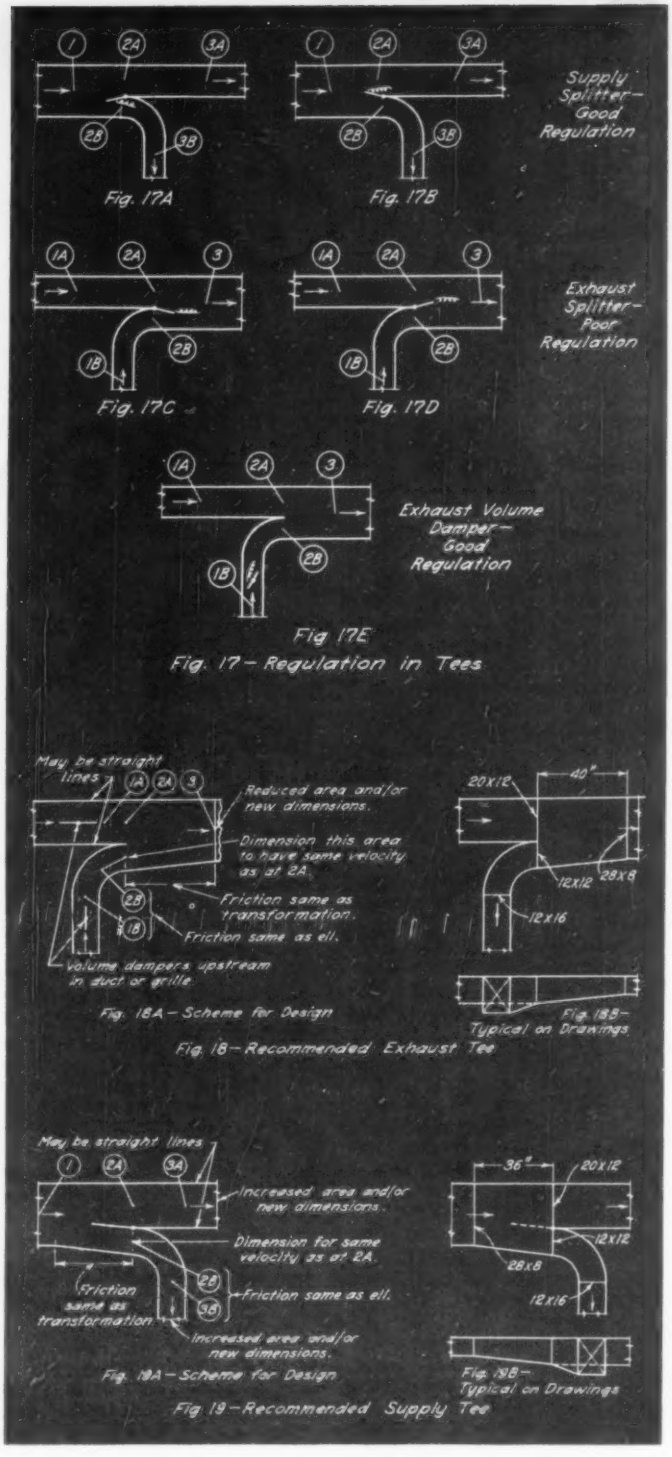
In Fig. 19 is shown a supply tee that could be adapted to most situations. The area at *2B* should be made to give the same velocity as at *2A*. In estimating friction, the loss from *1* to *3A* is one transformation; from *1* to *3B* it is one transformation plus one ell. Of course, any type ell may be used depending on circumstances, and of course, a splitter, not a volume damper, should be used.

Notes on Duct Sizing

In practice, the minimum permissible size of a duct is determined by the maximum velocity permissible. This maximum velocity is determined by the maximum permissible noise level. In the smaller ducts we find ourselves using low velocities near the outlets, increasing the velocities as we approach the larger trunks, and finally using perhaps the highest velocity at the fan.

These articles do not pretend to suggest the correct solution of noise problems. Permissible velocities, lower near duct outlets, will have to be picked by the reader. We are aware that to minimize noise, the ductwork should be streamlined, sharp edges may be rounded, soundproof duct lining may be used to keep high velocity noise in the trunks from travelling to the lower velocity outlets, duct walls may be reinforced to prevent vibration, and flexible connections may be used to prevent vibration from being carried along the metal duct walls. The use—and degree of use—of these facilities will have to be decided by the reader.

It is not always practical to give ducting the same pressure loss per 100 ft throughout. To do so involves a lot of arithmetic and reference to



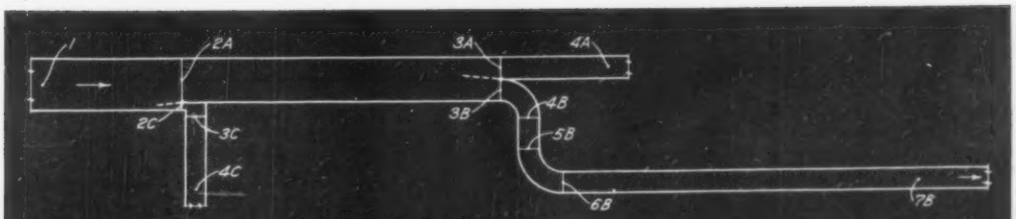


Fig. 20—Care in keeping pressure drop low should be used on the longest run.

charts. After the design has been completed, each section of duct should be checked over anyway and tabulated in order that the overall pressure loss may be known for picking a fan.

After a job is installed and the dampers set to give the specified flow to and from the exhaust and supply grilles, the pressure loss to every grille point is the same. This is true even on the shortest runs, those nearest the fan. In fact, the flow of air adjusts itself until this is so! We merely set dampers and splitters to bring about the desired flow at each opening.

On the short runs we find the dampers set to choke off the flow. It might be asked, Why not make the short ducts small and of high velocity to give this choking effect with a saving of material? Our reason for not doing so is our wish to keep a low velocity near the outlet and avoid noise. Then, in order to introduce resistance in this short low velocity branch, we crack a damper. This produces velocities and turbulence which might produce noise. All this seems an anomaly but perhaps it is a necessary evil. At any rate, at the present stage of the art, you can't design the short close runs so that their frictions equal that of the longest run. Adjusting the flow must be left to splitters and dampers.

We conclude, therefore, that care in keeping the pressure drop low should only be used on the longest run, and that a certain carelessness may be applied to the takeoffs for the short close runs.

Fig. 20 suggests this. The longest run is from *1* to *7B*. The short run to *4C* is not important—hence, the square turn without vanes shown at *2C-3C*. In order to keep the friction to the last outlet a minimum, flaps or splitters projecting into a duct without a change of size should not be used. They introduce turbulence and resulting friction in the path to the last outlet.

A policy of design could be adopted giving a low velocity near outlets to prevent noise, and stepping it up as the duct nears the fan. These rising velocity steps are not critical and may be applied approximately. At the start of a job a tabulation could be used somewhat as follows (q is one velocity head of the average velocity = inches of 32 F water column):

Narrowest duct dimension	Fpm	Sq in./ Cfm	q at 70 deg	q at 140 deg
Up to 10"	600	0.240	0.0225	0.0194
Over 10" to 20"	1000	0.144	0.0625	0.0540
Over 20" & up	1600	0.090	0.1600	0.1390

Actually, detailed application of the above is not important, except that for small dimensions, use a low velocity so the pressure loss will not be too high.

[This is the sixth of a series of articles by Mr. Walker on this subject. Earlier ones appeared in the March, May, July, September, and November 1949 issues. In April, some corrections and amplifications were published.]

Give to the
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1950
FUND

OVER 6500 A.C. JOBS IN CHICAGO

THERE WERE over 6500 air conditioning installations totalling some 166,000 hp in the city of Chicago at the end of 1949. The breakdown by type of building served follows:

	No.	Hp.
Amusements	83	3080
Banks	64	3766
Barbers	15	54
Beauty shops	43	301
Clubs	47	879
Doctors and dentists	68	326
Funeral parlors	187	1995
Hospitals	40	918
Hotels	110	5886
Laboratories	13	136
Mfg.—Baking	59	717
—Candy	121	8462
—Printing	74	4499
—Misc.	343	21494
Office and building	1522	41967
Residence	85	366
Restaurant	1417	18507
Stores—Candy	184	955
—Clothing	513	12608
—Drug	290	2650
—Food	113	1136
—Shoe	166	1265
—Misc.	685	7165
Studios	53	826
Theaters	249	26391
Total	6544	166,349

"BANNER YEAR" FOR AIR CONDITIONING SEEN

PRESENT indications point to 1950 as a "banner sales year for the air conditioning industry," W. F. Switzer, commercial sales manager of the Frigidaire division of General Motors, declared in a recent statement.

"In early years, many predictions were made regarding the broad future scope of the air conditioning business," he explained "and 1948 and 1949 have revealed a marked trend toward fulfilling these predictions." He said that 1950 is sure to be one of the greatest years for the industry sales-wise to date.

"In addition," Mr. Switzer pointed out, "there is every indication that this upward surge will not stop here. In reality, 1950 may well be the gateway to vast increases in the air conditioning business from year to year in the future."

Insulating Piping and Equipment at Mercury-Steam Power Station

A. C. ROMANIA, of the construction engineering division of General Electric Co., describes the insulation of the piping and equipment at a mercury-steam cycle power plant, where temperatures are of course quite high

A MERCURY UNIT power plant was put into operation a few months ago at the Schiller station of the Public Service Co. of New Hampshire, in Portsmouth.

Use of the mercury-steam cycle permits the attainment of thermal efficiencies of 34 to 38 percent. Efficiency of a vapor cycle depends to a large extent on the saturated temperature range through which it operates—the greater the range the higher the efficiency. The mercury cycle, superposed on the steam, results in a cycle of higher efficiency because of the high boiling temperature of the mercury. For example, mercury at 140 psig boils at 975 F while water at 1250 psig boils at 575 F.

Contributing to efficient heat utilization at this station is properly designed and installed thermal insulation.

The plant consists of two identical mercury units supplying steam to a turbine-generator. Mercury vapor is generated in each of the combined coal and oil fired boilers at 140 psig and 975 F. It flows through four vapor tubes, 12-16 in. in diameter, to the mercury turbine. Each turbine exhausts into two vertical mercury-condenser boilers at 2.58 psig, 524 F. The heat of vaporization released by the condensing exhaust vapor heats the water in the condenser-boiler tubes to produce steam at 640 psig and 496 F. The condensed mercury liquid then flows by gravity through a cleaning sump to a feed pump which returns the mercury to the boiler, through a 3 in. pipe line, to be re-evaporated. The unit is provided with 10 in. mercury vapor relief valves and piping.

Feedwater is supplied to the condenser-boilers in 4 in. piping at 375 F. Steam generated in the condenser-boilers goes to the steam superheater mounted directly above the mercury boiler in 8 in. diameter lines. There the steam is superheated by the flue gases to 825 F. Piping 18 in. in diameter serves as a relief line between the condenser-boiler and superheater casing. The superheated steam leaves the boilers in 8 in. lines which tie in with a 10 in. steam header supplying the steam turbine generator.

Steam is extracted from the turbine at the 6th, 9th, 12th and 16th stages, to supply the high, intermediate and low pressure heaters, the evaporator, and the deaerator. Pipe diameters include 3, 6, 10 and 16 in., and temperatures range from 150-640 F.

Piping and equipment were insulated with 85 percent magnesia and a high temperature type of insulation, used alone or in combination, depending upon the operating temperature. The combination takes advantage of the heat resistance of the high temperature material and the low heat conductivity of the 85 percent magnesia. Thicknesses are listed in the accompanying tables. The thicknesses were chosen so as to reduce radiation losses to an economic minimum.

Before insulation was applied, pipe and equipment surfaces were prepared by freeing them of dirt, debris, litter, etc., accumulated during construction and installation. Unless this precaution is taken, a tight insulation fit cannot be obtained, and a loose fit means that a good deal of the insulating value of the material is lost.

For both single and double layer insulation, care was taken to stagger joints within each layer and of one layer with respect to those of the other in order to prevent escape of heat via joints from the hot equipment surface to the atmosphere.

Major piping insulation at Schiller station

Type	Operating Temperature, F	Pipe size, in.	Insulation thickness, in. High temperature	Insulation thickness, in. 85% magnesia
Mercury vapor piping	975	12-16	2½	1½
Mercury vapor relief piping	975	10	2	2½
Mercury feed piping to vapor drum Mercury condensate piping	524	3-4	1	2
Mercury condenser-boiler feed water piping	375	4		2
Saturated steam piping between condenser-boiler and superheater	496	8		2½
Superheated steam piping Superheated steam header	825	8-10	1½	2½
6th stage extraction steam 9th stage extraction steam	640 530	6	1	2 5/16
12th stage extraction steam	485	6 10 16		2 5/16 2½ 3
16th stage extraction steam	150	12		1½
Steam ejector piping	100	6		1⅛
Steam relief piping	496	6		1⅛
Auxiliary exhaust lines	600	5 10	1½ 1½	1⅛ 2½
Building heating supply and return lines	275	up to 5		⅞, 1, 1⅛

Major equipment insulation at Schiller station

Type	Operating Temperature, F	Insulation thickness, in.* High temperature	85% magnesia
Mercury turbine high pressure shell	975	2	2
Mercury turbine exhaust hood Mercury condenser-boilers Mercury sump	524	1½	2
High pressure heater	640	1½	2
Intermediate pressure heater	530	1½	2
Evaporator	485	1½	2
Deaerator	375		3
Steam jet ejector	825	2	2
Low pressure evaporator condenser	230		2
Unit heating boiler	350		2½
Unit heating boiler flue	475		3
Fuel oil heaters	350		3
Air preheater	650	1½	2
Induced draft fan Precipitators—mechanical and electrical Gas and air ducts Stack	280		2
Ducts from air heater to burner box	572	1½	2
Pulverizer fan	450		3

*Thicknesses above indicated do not include the thickness of troweled-on finish insulating cements.

Depending upon size, piping was insulated with semi-cylindrical sections or with segments, butted tightly together and wired in place with No. 18 soft annealed iron wire, three loops being used per 3 ft section. On bends and turns, block insulation or short lengths of pipe insulation, cut and mitered to fit, were used. Around pipe saddles, hangers, supports, anchors, etc., pipe insulation was cut as little as possible to avoid breaks in the insulation. After application, all voids, cracks and irregularities were filled in and smoothed over with insulating cement.

To present a smooth surface for the finish, the insulation was wrapped with 16 lb asbestos paper. Some of the large diameter pipes were finished with a smooth coat of troweled-on asbestos cement. An 8 oz canvas jacket was then pasted and sewed on, not less than three stitches being used per inch of seam. To prevent charring of the canvas jacket on mercury-vapor lines at 975 F where pipe support lugs or piping connections extend through the insulation, glass cloth instead of canvas was pasted on for a distance of 12 in. around the lug or connection.

Except for a few special cases in which they were left bare, flanges were insulated with the same material and in the same thickness as the adjacent piping. Insulated flanges are desirable for three reasons—bare flanges can be a serious source of heat loss; the temperature gradient between the bare flange and the insulated pipe may result in warping of the joint; a hot, bare flange surface is a hazard for operating and maintenance personnel.

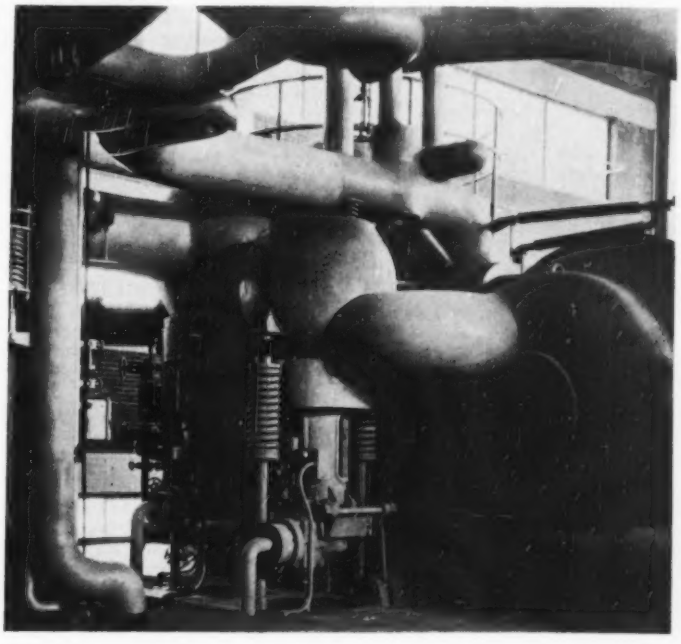
Removable insulation used on the flanges was constructed of preformed sections as well as blocks in the form of a continuous ring reinforced on the outer surface with metal lath and of sufficient length to overlap the adjacent pipe insulation for 2 in. at both ends. Space at the overlap was packed with insulating cement.

Valves and fittings also were insulated with blocks of the same type and thickness of material as the adjacent piping, valves being insulated up to the bonnet flanges. Standard blocks were cut and mitered to fit irregular surfaces, and each insulation piece was wired firmly in place.

Insulating cement was troweled well into all voids, depressions and cracks of the insulation on valves, fittings and flanges, and left with a rough surface. A smoothly troweled layer of asbestos finish cement was then applied to give a symmetrical appearance to the surface and, on valves and fittings, evenly beveled to meet the adjoining pipe insulation. A canvas jacket was pasted on over the cement as a final finish.

Equipment other than piping was insulated with blocks and, except for certain parts of the mercury boilers, finished with canvas. On these parts, the insulation was finished with asbestos cement, asphaltic-asbestos plastic, or metal casings, depending on operating conditions to which the insulation would be exposed. A resin finish was used on irregular surfaces in lieu of sewed canvas to achieve a smoother finish. Manhole covers, access doors, water box covers, plates, and other removable units were insulated individually so that they can be taken off without disturbing the body of the insulation.

Mercury piping, stop valves and inlet elbow to mercury turbine insulated with combination high temperature and 85 percent magnesia insulation finished with sewed canvas jacket



Submariner Explains Importance of UNDERSEA AIR CONDITIONING

HOWARD S. DEWEY writes at first-hand and in popular style of the reasons for and advantages of air conditioning the modern submarine. He has had several years of experience as an engineering officer in the "Silent Service"

TAKE AN ELONGATED section of sewer pipe, fill with the contents of one hardware store and a boiler shop, jump in yourself with 70 other men, air condition the whole affair, and you have the modern American submarine.

It wasn't always so good, though, for back before 1932 they didn't have air conditioning. Submarines operating in tropical waters on submerged maneuvers frequently returned to port with a crew that had lost an average of 10 lb per man. Without access to fresh air, the inside temperature would fly up above 100 deg and roost there. Heat haze rose in shimmering layers from hot machinery. Oil-filmed lamps cast a weak yellow glare which reflected from droplets of condensate that formed on every bare surface.

Air conditioning a submarine is a problem complicated by numerous conditions that can't be eliminated. There is continuous production of heat given off to the air by hot engines, storage batteries, galley stoves, electric lights, electric heaters, electronic equipment and human occupants.

There is also continuous production of moisture from storage batteries, human occupants, cooking, and water in the bilges. This production of moisture averages about 1000 lb of water per day under ordinary conditions. If the submarine is running on the surface, it is an easy matter to discharge this excess heat and moisture outboard. But if the submarine is submerged, it cannot be discharged outboard.

A submarine is practically all metal, and consequently is of course a good conductor of heat. In addition, the surface area of a submarine is fairly large. Moreover, the ocean is filled with convection currents, either natural or caused by the vessel's motion. These facts combine to make the heat transfer between submarine and ocean an active process. Even when the temperature difference between the vessel and the ocean is small, the total heat transfer is considerable because of the large contact area.

If the submarine is warmer than the ocean water, the interior heat of the vessel gradually passes through the shell into the water.

The temperature of the air inside drops and when it reaches the dewpoint the water vapor in the air begins to condense on every available surface. For this reason, the interior surfaces of a submarine are coated, wherever practicable, with insulation or an insulating paint to prevent or reduce this condensation to a minimum. The beginning of the condensation, however, depends upon the dewpoint and this can be controlled by air conditioning. Therefore, air conditioning is just as essential for this purpose as for the comfort of the crew. It is always advisable to lower the dewpoint before submerging the vessel if possible. In combat areas, though, such opportunities are rare indeed.

However, if the ocean is warmer than the submarine, there is a passage of heat from the water into the ship. Although small it adds to the interior heat. The same occurs if the loss of heat from the vessel to the ocean is less than the interior heat production. In hot summer weather, especially in tropical and subtropical regions, the air temperature in a submarine—regardless of air conditioning—may still rise to fairly high levels.

Although air conditioning equipment was first installed for the comfort of crew members, a second benefit became evident soon after its use. This was the reduction of electrical grounds resulting from the elimination of moisture. This secondary benefit has become a major one with the increased volume of electronic equipment being installed on submarines and is the joy of the electronics officer. Even in arctic areas penetrated by our submarines, the air conditioning units are operated for this reason.

For heating purposes World War II submarines used a direct current space heater with attached blower. These were voracious electricity consumers and occupied valuable space. When the submarine was charging batteries they could not be used. Also, during long sustained submergence, it was necessary to secure or reduce the heater output in order to conserve electrical energy for propulsion.

Consequently, heater use was restricted almost entirely to "dockside" periods when the submarine was in port. Many an engineering officer has been faced with the unattractive choice of depleting his batteries—a dangerous practice in combat areas—or staring down a chilled crew.

The lessons learned during World War II are being put to profitable use on new submarines under construction.

Air conditioning units to be installed on new submarines will have fresh water condenser intercoolers. The heat which passes into the fresh water from the hot refrigerant will be used instead of being dissipated as heretofore into sea water and then overboard. This will be done by placing a nest of tubes in the ventilation supply line just forward of the air conditioning evaporator.

The dehumidified air which leaves the air conditioning evaporator coils will be heated as it passes over the hot fresh water filled coils. The fresh water will be recirculated between condenser and heating coils in the ventilation line by a pump.

In warm weather areas, or when there is not sufficient heat dissipation in the heating coils, the air conditioning refrigerant can be piped to a sea water condenser such as is presently used.

This installation will require additional equipment and piping, but elimination of the space heaters is expected to compensate for this.

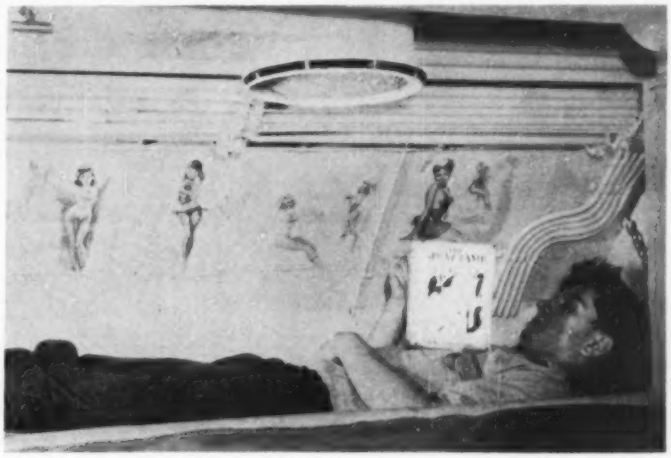
The air conditioning compressors, condensers, and pumps are located in the pump room, a cellar-like compartment beneath the submarine's main interior deck and approximately midway between the bow and the stern of the submarine. Crowded into this kitchen size compartment is an assortment of machinery that would make a creditable county fair exhibit.

To shape and install the interconnecting piping requires the patience of Job and the skill of a master pipefitter. In fact, submarine designers often describe their work as filling one large pipe with more of the same.

A wooden submarine, or mockup, built to the same dimensions as its steel mate, and including in its crowded interior wooden replicas of machinery that will be found in the actual submarine under construction, is used to simplify the problem. It serves as a pattern for the pipefitter and other trades.

Here, in comparative ease—without interfering with others actually engaged in constructing the submarine's hull—the pipefitter can route his templates, knowing in advance where all obstructions will eventually exist. In this manner piping can be mass produced for as many submarines as are being constructed from a single set of plans. In the turbulent haste of the last war this valuable contribution materially aided in reducing submarine construction time from 27 months to six months.

Fill a section of sewer pipe with the contents of a hardware store and a boiler shop, jump in with 70 other men, air condition the whole affair . . . . and you have a modern submarine, says the author. (Official U. S. Navy photos)



PRACTICAL PIPING PROBLEMS

By Robert C. Soronen

ROBERT C. SORONEN, engineer specializing in the design and supervision of heating, ventilating, air conditioning, industrial exhaust systems, process piping, and drying installations, gives some practical suggestions here—based on his wide experience—on methods of anchoring, guiding and supporting piping mains and risers.

ANCHORING, SUPPORTING PROCESS PIPING

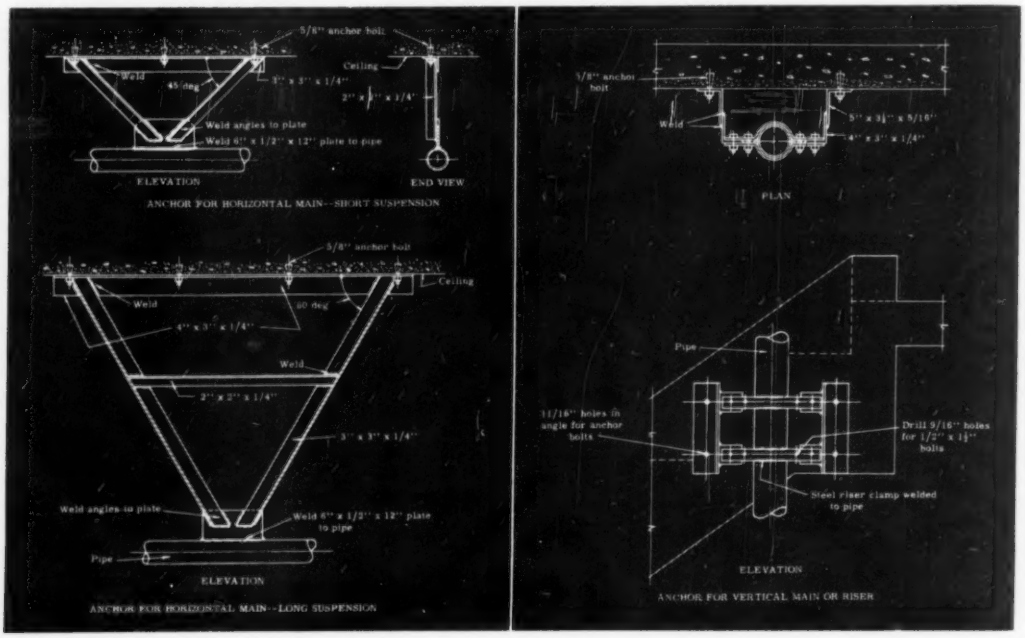
INSTALLATION of piping for industrial process work necessitates careful planning not only in the routing of the mains and submains but definite forethought with respect to pipe line anchors, guides, supports and hangers. These items are the very backbone of the piping system.

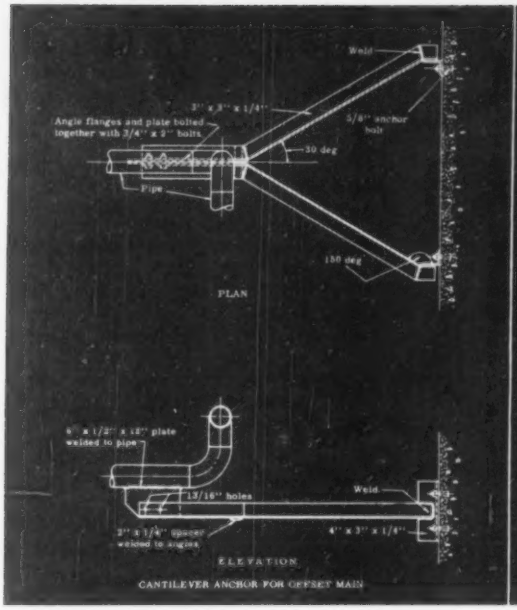
A piping system may be of perfect design regarding pipe size, provisions for expansion and contraction, and in the mechanics of installation, such as welding and fitting, but this perfection can be readily destroyed in short order through the lack of correct and substantial anchoring, guiding, supporting and hanging.

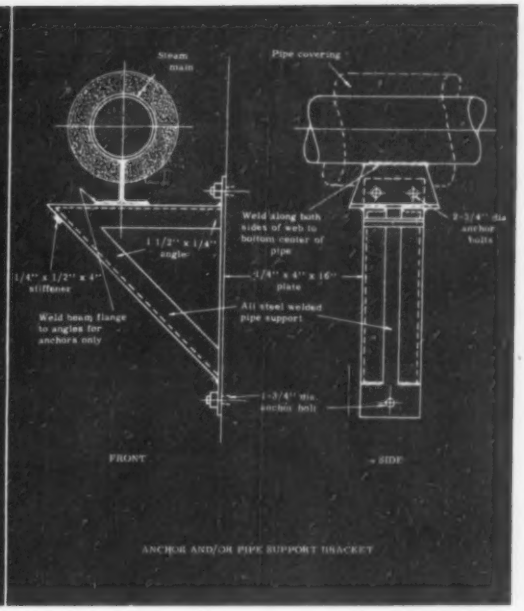
Described and illustrated here are details of several versatile types of anchors, guides and supports (either shop or field fabricated) which I have used with success in numerous instances. Each assembly is constructed from standard materials, such as standard simplified structural steel shapes, standard weight schedule 40 black steel pipe, standard type riser clamps, machine bolts with hex nuts, and anchor bolts of an approved type.

Anchors for ceiling or roof suspended horizontal mains, either short or long drops, consist of angles, plate and anchor bolts. Short suspension anchors are made up of a 3 in. x 3 in. x ¼ in. ceiling piece, 2 in. x 2 in. x ¼ in. drop pieces and a 6 in. x ½ in. x 12 in. long steel plate. Long suspension anchors include a 4 in. x 3 in. x ¼ in. ceiling piece, 3 in. x 3 in. x ¼ in. drop pieces, a 2 in. x 2 in. x ¼ in. stiffener, and a 6 in. x ½ in. x 12 in. long steel plate. All pieces are cut to the required lengths, beveled for the proper angle in degrees, and assembled by means of welding into a unit. The completed unit is then erected into place, fastened to the ceiling structure with anchor bolts, and the plate is welded to the top center line of the pipe.

Anchors for risers are constructed from angles, riser clamps, machine bolts with hex nuts, and anchor bolts. To make the supporting members, two 4 in. x 3 in. x ¼ in. angles, each 2½ in. long, are welded to a 5 in. x 3½ in. x 5/16 in. angle 12 in. long. Next, one hole is drilled in each of the four "ears" or mounting flanges for fastening the clamps. The supports are anchored to the building wall or stairwell, being careful to limit the spread to fit the length of the clamps. If the clamps are too long, the ends can be cut to fit the desired span. The riser clamps are placed around the pipe, bolted securely together, and the clamp is welded to the pipe



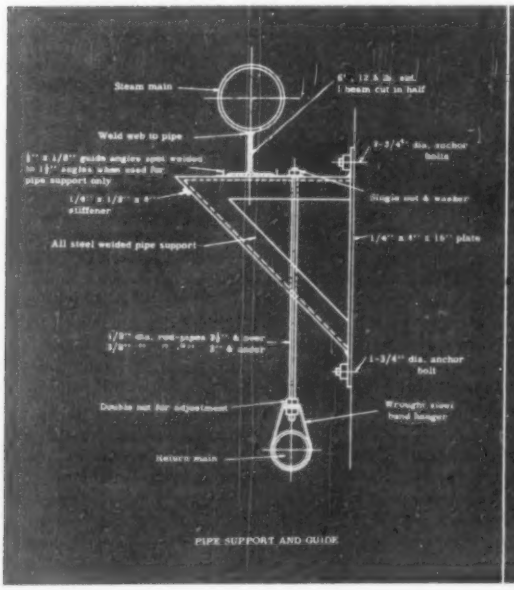


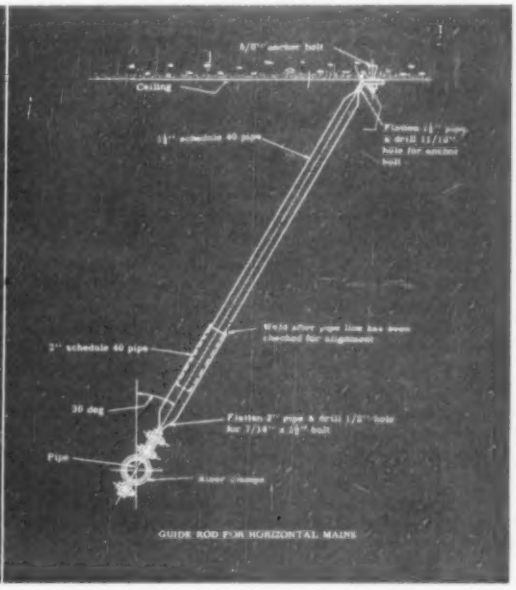

Steam main
Pipe covering
Weld along both sides of web to bottom center of pipe
2-3/4" dia anchor bolts
1 1/2" x 1/4" angle
1/4" x 1/2" x 4" stiffener
3/4" x 4" x 16" plate
All steel welded pipe support
Weld beam flange to angles for anchors only
1-3/4" dia. anchor bolt
FRONT
SIDE
ANCHOR AND/OR PIPE SUPPORT BRACKET

circumference along the arc of contact.

An anchor for a horizontal offset main, cantilevered on supporting angle flanges from the wall, can be bench fabricated from the illustration. Material includes two 4 in. x 3 in. x ¼ in. angles as support members, 3 in. x 3 in. x ¼ in. cantilever members, a 6 in. x ½ in. x 12 in. steel plate, 2 in. x ¼ in. spacer, machine bolts with hex nuts, and anchor bolts. Hangers on the pipe lend support to the anchor unit.

Mains that are routed close to walls can be conveniently supported, anchored, and guided by a many-purpose, all steel welded bracket. It is made up of a 4 in. x ¼ in. x 16 in. plate, 1½ in. x 1½ in. x ¼ in. angles cut to size and welded to the plate, a ¼ in. x ½ in. x 4 in. stiffener, and anchor bolts. A 6 in., 12.5 lb standard I beam cut in half and welded to the bottom center line of the pipe becomes the pipe stand. Designation of the complete unit as an anchor or a combination support and guide depends


Steam main
6", 12.5 lb. std. I beam cut in half
Weld web to pipe
1-3/4" dia. anchor bolts
Angle cut & washer
1/4" x 4" x 16" plate
All steel welded pipe support
1-3/4" dia. anchor bolt
Double nut for adjustment
Wrought steel band hanger
Return main
PIPE SUPPORT AND GUIDE


5/8" anchor bolt
Ceiling
1½" schedule 40 pipe
Flatten 1½" pipe & drill 11/16" hole for anchor bolt
Weld after pipe line has been checked for alignment
2" schedule 40 pipe
30 deg
Flatten 2" pipe & drill 1/2" hole for 7/16" x 1½" bolt
Pipe
Riser clamps
GUIDE ROD FOR HORIZONTAL MAINS

on either of the following methods employed.

1) To provide a pipe line anchor, the flanges of the pipe stand (one-half I beam) are welded to the top angles of the bracket as shown on the anchor and/or support detail.

2) To use the unit as a combination support and guide, ½ in. x ½ in. x ⅛ in. angles are welded to the top angles of the bracket, allowing a minimum of 1/16 in. clearance between the guide angles and the I beam flanges for pipe movement. See detail of pipe support and guide.

As illustrated on the detail of the pipe support and guide, the same bracket may be employed to support a return main or other pipe simply by provision of a hanger rod, top nut and washer, band hanger and adjustment nuts.

It is important that suspended horizontal mains be properly guided, and a device for doing this is illustrated in the detail of the guide rod for horizontal mains. Material use involves short lengths of 1½ in. and 2 in. schedule 40 black steel pipe, one end of each "swedged" or flattened and drilled, riser clamps, machine bolts with hex nuts, and an anchor bolt. The telescoping pipes are welded in a fixed position after the main has been aligned for proper pitch.

The location or spacing of pipe supports and hangers, as well as pipe guides, must follow a definite schedule. With the use of either welded steel wall brackets or suspension type heavy malleable iron adjustable hangers, the following schedule has been found useful; furthermore, it will usually fall within the limits fixed by codes or specifications:

Pipes up to 1¼ in.; hangers not over 8 ft apart.

Pipes 1½ to 2½ in.; hangers not over 10 ft apart.

Pipes 2½ to 3½ in.; hangers not over 12 ft apart.

Pipes 4 to 6 in.; hangers not over 14 ft apart.

Pipes 7 to 12 in.; hangers not over 16 ft apart.

As a rule, pipe guides are placed between pipe supports or hangers at equal spacings.

How to Use Antifreeze Solutions

THE COMMITTEE on radiant panel heating of the Heating, Piping and Air Conditioning Contractors National Association has had a number of inquiries from association members on the use of antifreeze solutions of the glycol type in snow melting and panel heating systems. To help in answering such questions, a report by P. B. Gordon, chairman of the committee, has been published in the HPACCNA's Official Bulletin.

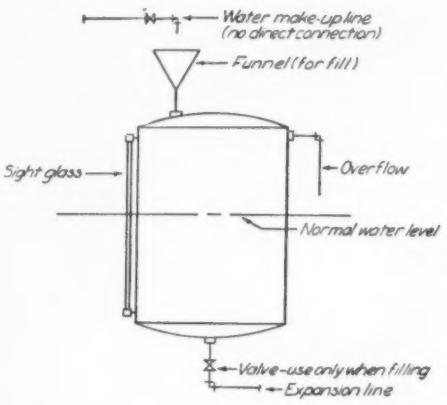
The following "installation suggestions" were given as a part of this report:

1) Wherever possible avoid heating the antifreeze solution in a coal, oil or gas fired heater or boiler. Use a heat exchanger with hot water below 285 F or steam below 40 psig as the heating medium.

2) Weld steel or wrought iron pipe or solder copper tubing as far as possible. Use as few threaded joints as possible. (At valves, heater connections, pumps, etc.)

3) Do not make any direct domestic water connection to a snow melting or panel heating system containing antifreeze solution. This will protect against possible back-contamination of domestic water system and also prevent inadvertent dilution of antifreeze. It is suggested that the circulating system be of the open type using a vented expansion tank, both for expansion and as a charging tank to add water (and antifreeze solution) in measured amounts.

4) It is important that the correct values for pipe friction losses and heat transfer be used in selection of pumps and heaters when circulating solutions of water and antifreeze. Circulating pumping heads may be increased as much as 40 or 50 percent over the heads required to circulate water. The heat transfer values within the panel coils or snow melting coils are not affected by the use of antifreeze, as the limiting factors that determine the overall heat transfer are located outside of the pipe. However, the use of ethylene glycol and water within a heat exchanger will change the heat transfer coefficients due to changed viscosity and specific gravity, and thus increase the size of heat exchanger by as much as 100 percent. The manufacturer of the heat exchanger should be consulted to determine the accurate performance when heating water and glycol solutions.



OPEN SYSTEM EXPANSION TANK FOR SNOW MELTING SYSTEMS

Sam Lewis' Page

INFORMAL comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, and member of HPAC's board of consulting and contributing editors

Notes on Ventilation for Churches and Auditoriums

VENTILATION means the promotion of health and comfort by aeration. Aeration or ventilation, in its broad sense, means not only providing air movement to aid in controlling temperature and relative humidity, but also involves provisions for combating unpleasant odors and for reduction of dust.

Necessity for ventilation comes about because people require roofs and walls in most climates. They have learned that they live more effectively in environments relieved from the vagaries of the outdoor weather. Any place of assembly, for example, should be sheltered from excessive cold and heat. Most such rooms require protection also from the noise caused by transportation vehicles.

Traditionally, a church auditorium has massive walls capable of considerable heat storage. These heavy, thick structures promote rather slow temperature changes.

There are examples of ancient cathedrals that had no built-in heating apparatus and which, prior to some important assemblage, were heated by portable temporary equipment operated for several hours before occupancy. The apparatus then was removed. The heat storage, however, provided comfort during the ensuing limited occupancy.

The resistance to quick heat transfer inherent to thick stone walls, columns and buttresses is absent in most modern construction. No auditoriums in temperate zones are built without permanent heating systems, and if they have deviated from the great height and large air space of tradition, require equipment for continuously replacing the air that otherwise would accentuate the "odor of sanctity." The spent air must be replaced or at least must be diluted with new air from outside. The replacement air requires heating to avoid complaint of drafts.

Drafts may be due to too great a difference in temperature between the entering air and that already in the room or to inadequate diffusion of the new air or to its introduction from an unfortunate direction with reference to the people. A man will endure with considerable tolerance a lively movement of air coming toward his face, but if the air current impinges against his back, the man may develop fear that he will catch a cold.

There are several schemes available to the ventilating engineer for injecting ventilating air into a room devoted to human assembly. Many of them succeed if the air enters overhead, at very low speed through a great number of orifices. An example of this method of air introduction may be seen in some railway cars, where the whole ceiling becomes an air grille composed of thousands of closely-spaced tiny openings.

In an auditorium having a flat ceiling, it is practicable to install a series of grilles of this type, supplied from ducts above a suspended ceiling. The vaulted ceiling of a church auditorium of the older style, innocent of any attic, gives no such opportunity for concealed air supply ducts and some other scheme must be used.

It is possible, with a cooperative architect, to deliver large volumes of air through relatively enormous grilles in the wall toward which the audience faces.

Successful installations have been made using overhead grilles along the sides of the room, the entering air flowing toward the ears of the people, but at an elevation sufficiently high to avoid too violent impingement on their heads.

Many reasonably successful audience rooms that have fixed seats endure introduction of the air supply through the floor, by mushroom type hoods, around which the air flows gently and horizontally—eventually to rise to exhaust openings somewhere overhead.

Objections to this scheme are that the temperature of the entering air must conform very closely with the temperature of the air at audience level, and that the ducts to serve the mushrooms from the room under the auditorium interpose a construction problem. If the room air, with the mushroom plant, is appreciably warmer than the entering air, the heavier, cooler, new air tends to spread along the floor, and people may complain of cold feet.

It is desirable in some church auditoriums to maintain a comfortable temperature at all hours for the relatively few people who enter to meditate or pray.

During these times of sparse attendance, it is costly to operate a ventilating system, and economy is achieved by mere heating at minimum fuel expense.

Several recent installations, definitely acceptable and not unduly high in cost, employ warm water circulated through pipes embedded in the floor. With this application of radiant heating, the floor and the seats can be kept at a moderate temperature regardless, to a surprising extent, of the temperature in the zones overhead that may be cooled by the influence of walls and windows.

Confer on Weather and Building Industry

MORE THAN 300 engineers and scientists attended the first research correlation conference of the National Research Council's Building Research Advisory Board, held in Washington, and entitled Weather and the Building Industry. The conference considered recent climatological research and its effect on building design, construction, materials and equipment.

The first session heard papers on recent research in climatology by Dr. Paul Siple, military geographer of the U.S. Army general staff, Dr. Helmut Landsberg, executive director of the committee on geophysics and geography of the Research and Development Board, and Arnold Court, of the environmental protection section of the Quartermaster Corps. Dr. Siple reported on new kinds of analysis of the macroclimate, based upon climate zones surrounding 15 typical U. S. cities, while Dr. Landsberg emphasized the importance of the microclimate, showing that within a quite small area, considerable differences in climate may be caused by hills, bodies of water and other topographical features, or by the extent of forestation or commercial building. Both speakers stressed that within either a climate zone or only a few square miles, there were sufficient variations in climate to make it desirable to consider them in any design or construction.

In the general discussion following the first session, Dr. Charles F. Brooks, director of the Harvard Blue Hill observatory, proposed the use of true maximum conditions, instead of 5 yr mean conditions, as design safety factors in building. Although 5 yr data on temperature, humidity and solar load were considered reliable, data on snow load and wind velocity were not, and building failures have resulted from unusual storm conditions.

Prof. F. B. Rowley, of the University of Minnesota, in reviewing the factors bearing on a choice of wall insulation, stated that the wet bulb temperature was being recognized as a key problem now, since moisture condensation in the insulating space not only reduces the efficiency of insulation but may deteriorate parts of the structure as well. While it was formerly thought that condensation difficulties were largely confined to the north, where condensation within the structure may occur in cold weather due to fairly high indoor humidity, it is now known that the trouble is widespread wherever high humidities prevail—in the relatively mild Pacific northwest, for example.

Prof. F. E. Giesecke described research on experimental houses in Austin, Texas.

A research problem was immediately suggested by the viewpoints found in the papers of Professors Rowley and Giesecke. The relationship of the "mass"—i.e., heat storage capacity—of the wall to the comfort of the occupants may well be different in different climates, with a thick masonry or adobe wall more suitable in large diurnal temperature ranges and a thin, well-insulated wall preferable where there are periods of a week or two with extreme temperatures.

Most of the discussion of the third session, on climate and design, concerned the problem of summer comfort, and natural ventilation with low wind velocities. Natural climate control vs. mechanized control was never an issue at the conference, since it was agreed that any desired conditions could be produced if the budget would allow the purchase of sufficient air conditioning equipment; but the architects on the discussion panel emphatically stated that much could be done by correctly employing natural ventilation, with considerable saving resulting.

Dr. Ralph Linton, professor of anthropology and chairman of the institute of human relations at Yale university, pointed out that the ideal climate within a building occurs in the spring and fall, when the structure is open and the heating plant is not operating. With an air temperature of about 65 F and moderate humidity, and the walls warmed to 70 F by the sun, the occupant will feel comfortable; whereas, it was agreed, in a building where the air temperature is 70 F but the walls are at 60 F, as occurs in some structures in the wintertime, the occupant will feel chilly because of the increased loss of body heat by radiation to the walls. Although the ideal wintertime arrangement might be 60 F for the air and 80 F for the walls, natural ventilation would probably be insufficient to maintain this.

William B. Caudill, research architect of the Texas A & M engineering experiment station, described research in summer ventilation and orientation toward sun and breeze, studied by using scale model structures mounted on a turntable. While the use of a shade overhang to shield the windows from the sun in the summer was unquestionably efficient, it seemed to interfere with the air circulation in the building, since warm air leaving at the top of the window became trapped under the overhang. Normal circulation was re-established, however, by louver perforations in the overhang.

The last session of the conference, on climate and indoor comfort, considered the problems of heating, ventilating and air conditioning engineers, and more quantitative standards of the collective effect of weather conditions. It was stressed that the concept of weather design data is changing, and that where once only the dry bulb temperature was considered in establishing a design temperature for heating, modern design considers the wind velocity, solar load, and wet bulb temperature as well. For example, it was pointed out that many buildings have too large and wasteful a heating plant, because their old-style "design conditions" were for —5 F and the average wind of 15 mph, whereas in most parts of the country quite low wind velocities accompany such temperatures.

John Everetts, Jr., consulting engineer, Philadelphia, described the effect of climate on the design of a house, a theater, and an office building, for Chicago, St. Louis, and New Orleans, pointing out that greater modifications must be made in the smaller structures to adjust for the climate. In addition to the dry bulb temperature, humidity, and ventilation factors, the complications of the lighting and the number of occupants influence design in commercial buildings.

QUESTION OF THE MONTH

What Air Conditioning For 21 Story Building?

WHAT TYPE OR types of air conditioning systems would be "most satisfactory" for the top 20 floors of an existing 21 story office building? That was the Question of the Month, from "G.B.", published in the January issue.

The most important requisites that any system selected for this application should have are: a) Ability to work in with existing equipment; b) Minimum space requirements; c) Flexibility of control; d) Low first cost; e) Low operating and maintenance costs. All are so necessary to ultimate satisfaction that no attempt has been made to list them in their relative order of importance.

Anyone undertaking to air condition an existing building of the size given has to choose between some 10 to 15 basic systems. In my opinion, a basic system which meets the above five requisites is one which uses hot and cold water as sensible heating and cooling media, and high pressure, dehumidified air as a means for controlling humidity and for providing ventilation and air motion. This system is of advantage when it comes to installing air conditioning in existing structures because of the comparatively small amount of space required by its water lines and high pressure air conduits.

The air side of the system consists of filters, dehumidifiers, compressors, preheating coils and the necessary number of round insulated ducts (conduits) for conveying the high pressure air to the spaces throughout the building.

The primary air handled by the central station equipment is usually all, or nearly all, outside air in amounts sufficient to balance exhaust from toilets, restaurants, etc. and to provide ventilation for the offices. In the cooling season, this primary air is dehumidified in accordance with the latent heat gains of the conditioned spaces, and relative humidity control is accomplished through control of its temperature. In the heating season, the primary air is heated and humidified and again serves as a medium for humidity control in the spaces. Dry bulb temperatures are controlled in each space by regulating the amount of hot or cold water to an air handling unit.

Careful study and analysis is required in selecting primary air fans or compressors that will not be objectionably noisy. Noise is a major problem but can usually be overcome by good design and application engineering.

The individual room units consist of a plenum to which the primary air is piped, primary air nozzles, water coil for secondary air, primary and secondary air mixing chamber and discharge grille—all housed in a finished steel cabinet. High velocity primary air from the nozzles induces a flow of secondary air through the water coil in the ratio of approximately four parts of secondary air to one of primary. After mixing, the combined air is discharged vertically into the room through an adjustable discharge grille.

The units could probably be selected to fit in the spaces now occupied by the existing radiation. A minimum of cutting and patching is required for their installation because of the small size of water, air, and drain lines serving them, and the absence of electric wiring and outside air intakes.

The water side of the system consists of refrigeration compressors, condensers, water chillers, cooling towers, water heating equipment, and water distribution piping.

A 21 story building, 80 ft x 115 ft, in a 40 deg latitude, location might require from 500 to 700 tons of refrigeration. For this load, economics and control flexibility would probably dictate selection of two or three centrifugal compressors with variable speed drives. A cooling tower installed on the roof is indicated for the condensing water system.

Steps should be taken to convert the existing heating plant to furnish hot water to the room units and steam or hot water to the primary air preheat and reheat coils.

The piping system should be designed so that either hot or cold water can be sent to the room units in response to the zone controls. This reduces piping requirements for each unit to water supply line, water return line, and condensate drain line for the pan under the secondary air cooling and heating coil.

The zone controls should be under the supervision of the building engineer and should be grouped in one control room adjacent to the main apparatus area. Basically, the zone controls respond to the outside temperature by operating valves to give more or less cooling or heating to the water. The temperature setting for any particular zone would be modified either manually or by an automatic reset device responsive to the sun exposure of its zone. Individual room control would be by a thermostat responsive to the room dry bulb, operating a modulating valve to vary the amount of water to the unit heat transfer coil.

For large open spaces—such as auditoriums, restaurants, etc.—where it is impractical to employ units, a conventional duct distributing system is usually required. While such systems necessitate separate apparatus rooms for fans and air conditioning units, their heating, refrigeration, ventilation and dehumidifying air requirements can come from the treated water and air conduits which serve the individual room units.

It should be emphasized that adapting any air conditioning system to an existing large building requires far more painstaking design and analysis of details than is the case for a new building. The job should be under the supervision of engineers having extensive experience in this type of work. They should furthermore be renowned more for their genius in making the practical compromise than for achieving ultimate perfection, if the cost of the job is to be kept within reasonable limits.—F.C.J.

ROOM AIR TEMPERATURES IN ICE SKATING RINKS

IN ORDER TO answer the Question of the Month which was published several issues ago concerning data relative to room air temperatures that exist in a room containing an ice skating rink, it must be assumed that the reader seeking the data is interested in estimating the room air temperatures so that he can approximate the additional load to the rink due to the room air temperature, whatever it may be, and thereby control the condition of the ice surface.

Not only air temperature, but air circulation, relative humidity, radiant heat from artificial lights, and the latent heat of freezing the water all affect the heat loss from the surface of the floor. If the air near the ice is motionless, no appreciable transfer of heat will result, and if the air near the floor is perfectly still and dry, a good insulation to floor loss is provided.

As skaters pass over the ice, warm air is fanned downward by their movement and then, of course, the load on the refrigeration plant serving the rink is increased to maintain the desirable ice surface for the skaters. Therefore, the ice surface can be quickly and easily controlled by controlling the temperature of the air and the amount of movement of the air over the ice surface.

The accompanying curves may be of help in answering this question. They are reproduced by permission from the Data Book—Applications Volume, published by the American Society of Refrigerating Engineers. —R.R.

TWO BOILERS WITH COMMON BREECHING

ANSWERING THE recent problem concerning two sectional boilers in a high school, one to be converted to gas firing and connected to the common breeching, the solution to proper operation is by efficient dampering, preferably by automatic controls.

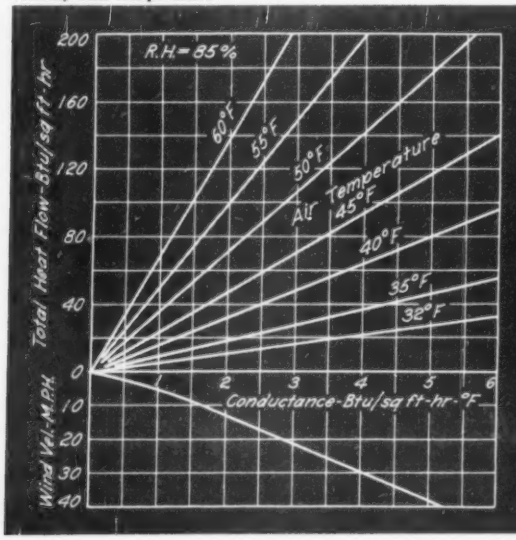
In firing with any type of fuel a certain amount of air is required for combustion. Too much excess air results in loss of efficiency and economy, and lower capacity. Both coal and oil require more air for proper combustion than does natural gas. Therefore, with each unit having equal load, to maintain the proper overfire draft, the unit being fired with gas will be dampered to the closed position more than the coal fired unit, the position of the dampers depending on draft available in the breeching and amount of air used for combustion.

The importance of proper use of dampers is more than emphasized in the article on page 79 of the December 1949 Heating, Piping & Air Conditioning.

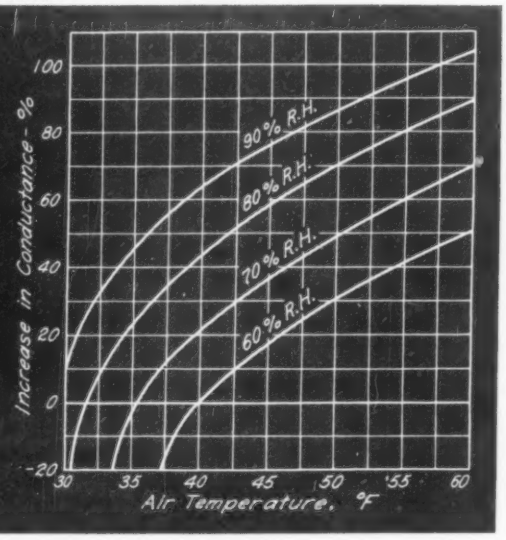
We recently had a somewhat similar problem, with the variation of having two 300 hp boilers and a 500 hp boiler on common breeching with the larger boiler carrying the load in the same proportion. No difficulties have ensued, due to keeping our overfire draft and excess air at the minimum level. The problem was similar because the larger unit required more draft and more air than the smaller boilers. More draft was obtained by a larger opening into the breeching, more air by a larger fan.

In summation: Since enough draft was available for firing the sectional boilers referred to in the problem with coal or oil, more than enough draft is available for gas. The problem is therefore to reduce draft, which can be done simply by dampering.—M. A. M.

Heat transfer from air to ice surface as affected by air velocity and temperature



Effect of air humidity on heat transfer from air to ice surface



Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Plant Research in the Phytotron

By Arthur J. Hess*, Los Angeles, Calif.

SUMMARY—This paper emphasizes the role of heating and air conditioning in the control of environmental conditions for the growth of vegetation. A laboratory is described in which plants are grown in a synthetic sterile medium and not in soil. The Phytotron contains many air conditioned rooms, with plants being moved on carts from room to room. One problem of the laboratory designer was the control of solar radiation; this was accomplished by the use of a roof spray saving 275,000 Btu per hr on the cooling load. Air flow, also very important in plant research, is controlled in the laboratory by an unusual method of air circulation through the floor.

A PROJECT now being carried on at the California Institute of Technology is concerned with the study of the most common and the simplest solar energy gathering machines—growing plants. It is well known that plants, by the process of photosynthesis, change the sun's radiation into chemical energy and lock it into the plant in the form of starches and sugars made from water and the free carbon dioxide in the atmosphere. The process breaks down the CO_2, discarding the oxygen back to the atmosphere and using the carbon and water to make up the starches and sugars. Thus many ordinary field plants store up huge amounts of solar energy in a few months, which can be released in two ways of interest to the engineer: (1) direct combustion of the plants to produce heat; (2) conversion of plant sugars and starches into alcohol, a good fuel which can be stored, transported, and utilized in existing facilities.

Another important subject under study at the laboratory is food production. With an expanding world population, the problem of supplying food for all has become increasingly important. This project, which has been going on at the California Institute of Technology for the past 11 years, involves the *phytotron*, so named because it performs the same function in plant research that the cyclotron does in nuclear research. The problem of increasing food production can be solved by: (1) increasing the efficiency of growing plants; and (2) by increasing the efficiency of agricultural processes. Almost all agricultural progress has been in cultivation equipment and cultivation methods with some progress in plant breeding, but knowledge of the actual growth of plants, their photosynthetic efficiency, and their dependence on climate and weather is little changed from prehistoric times.

*Member-Owner of Hess-Greiner & Polland. Member of ASHVE.

Contributions of the Phytotron

Work at the phytotron has shown that the function of the soil is minor compared with that of the atmosphere and sun. A few years ago such a statement would have been surprising, but it is now known that the major function of the soil is to provide support for the plant structure, meter moisture to the roots and supply the small amount of minerals required by the plant. All of these soil functions have been done in the laboratory with a synthetic sterile medium in which the roots can grow. This involves the now familiar science of Hydroponics: wherein plants are grown with roots immersed in nutrient solutions without any soil or solid media whatsoever for root growth.

The laboratory at the California Institute of Technology is built to study all the environmental conditions of plant growth both for roots and superstructure. Studies to-date establish the fact that the average field plant is about ½ per-

cent efficient photosynthetically. Work now in progress at the laboratory indicates that this can be increased to 4½ percent, a low figure, but still nine times the efficiency now obtained on the farm. Little need be said concerning the tremendous political and economic significance of these figures, which would mean that with the same growing facilities including land, machinery, labor and water, the nation could increase its output of food nine times.

Medicine—Another potential accomplishment of this research project indicated by studies to-date is its contribution to medicine. Many diseases and ailments of the body result from a deficiency of some chemicals used directly in the body structure, or as catalysts to control natural functions. In their natural state which is usually inorganic, many of these chemicals cannot be assimilated by the body, but if these chemicals are fed to plants first and thus made to take on an organic character they can be assimilated easily by the body. The study of the methods of feeding plants the desired chemicals was discontinued about 1941, because of a shortage of technical personnel and funds.

A drug to control high blood pressure, a major mortality cause, has recently been found in a wild plant. The new drug can be extracted from the plant, but the plants are so few in number and are located in such inaccessible areas that practical production from natural sources is impossible. At the phytotron laboratory, a study of the environmental requirements of this plant is now going on. It is hoped that with the data obtained this new drug can be produced commercially in the United States.

Seed Control—An additional important result reached by the laboratory has been to establish a complete control of seeds by the elimination of all sources of flower contamination due to errant pollens, seeds, yeast spores and mold spores either air borne or insect borne. Thus scientists will be able to crossbreed plants with accurate ancestral records together with complete control of all genealogical factors. It is probable that within the next 20 years all seeds will be grown under such controlled conditions, requiring large greenhouses equipped with air conditioning.

Smog Research—Air pollution or "Smog" research is also an important part of the work at the phytotron. Human nature is one of the major problems in investigating air pollution because of individual differences regarding reports of exposure to polluted air. Plants, on the other hand, are secure in one position and are unable to talk and therefore make good subjects for use in "Smog" investigations. This was accidentally discovered in the Phytotron when it was found that purging of refrigerant gas which was leaking into a condenser caused plant damage simultaneously with the purging of the condenser. This experience led the scientists in charge of the laboratory to conclude that many gases in the atmosphere existing in minute quantities could be investigated with respect to plant damage and also with some respect to effects on humans and animals.

History of the Phytotron

It would be difficult to give a complete history of the phytotron without an acknowledgment to those scientists both great and near great who contributed over the centuries to the small fund of knowledge on the subject of growing plants. The acknowledgment of modern times is due Dr. H. O. Eversole of La Canada, Calif., who started the modern and accelerated research into this subject. Dr. Eversole is an orchid grower who built an air conditioned greenhouse to reproduce the native growing conditions (including both day and night) of orchids by which he obtained phenomenal growing results. Others became interested in the project, the first being the U. S. Department of Agriculture. In 1931, the Department under the direction of Dr. L. C. Marshall, a physicist,

Fig. 1—Architect's drawing of external view Earhart Plant Research Laboratory

Fig. 2—Plan of laboratory ground floor

Fig. 3—Plan of laboratory basement

constructed an air conditioned greenhouse at La Jolla, Calif., and obtained valuable data on Papaya plants.

Air conditioning engineers showed keen interest in the La Jolla project but, strangely enough, not because of the air conditioning for plants, but because it was one of the few successful heat pump installations then in operation. From the results of these two installations, Dr. Eversole in 1938 raised funds and persuaded the California Institute of Technology to construct the first unit of the phytotron. The project was placed under the direction of Dr. F. W. Went of the Biology Department at the Institute. With the small pilot laboratory, he obtained such important results that the Earhart Foundation of Ann Arbor, Mich., supplied funds for the construction of the main laboratory now in operation.

The project is now beginning to awaken world scientific interest and similar laboratories are being built or contemplated in South Africa, Canada, Belgium, and India with arrangements for interchange of scientific data and personnel.

Purpose of the Plant Laboratory

The phytotron (Fig. 1) is a plant research laboratory designed to control all the environmental conditions of growing plants for both superstructures and root systems including: control of temperature, humidity, and sterility of the air; the food supply, the chemical and sterile quality of all water supplies; all light sources both as to intensity and spectral qualities. Every precaution is taken to maintain all of the environments sterile after originally sterilizing them.

Mechanical Arrangement of the Phytotron

A survey of the requirements of a Phytotron indicates that a mechanical engineer would find a real professional interest in the design of such a project, since it is essentially

a series of air conditioning systems with a building around them. When this is complicated by the usual request from the owner to design twice as much laboratory as available funds permit, the engineer is faced with a problem.

The phytotron, though only a small building approximately 80 ft × 125 ft with a ground floor (Fig. 2) and basement (Fig. 3), contains the following:

a. Six air conditioned greenhouses for growing plants under natural sunlight, with provision to maintain day temperatures from 58 F to 90 F and night temperatures from 50 to 68 F. All these temperatures may be combined with any desired relative humidity from 15 to 90 percent.

b. Thirteen air conditioned laboratories provided with artificial light and equipped to maintain conditions from 35 F to 90 F with any relative humidity from 15 to 95 percent and with light intensities up to 1500 C.P.

c. Eleven dark rooms all equipped to maintain 35 F to 90 F with any relative humidity from 15 to 95 percent.

d. Ten laboratories of various sorts all air conditioned as required:

Five laboratories that are light conditioned
One laboratory for maintaining zero dew point with temperatures of 40 F and above
One for radioactive experiments
One for all types of gas experiments
One equipped with a wind tunnel for wind experiments
One with provisions to produce fog or rain.

In addition, the phytotron is equipped with harvesting, grinding, and drying rooms; a chemical laboratory for the analysis of the harvested plants; a photographic studio and laboratory; and receiving and potting room with sterilizing equipment for all entering plants and materials. These systems require 21 air conditioning units of various types.

Experimental Conditions

In order to provide flexible operation for the relatively large group of plant researchers, the phytotron is designed so that each individual laboratory is set up at a predetermined condition and the plants are moved from laboratory to laboratory in accordance with the schedule set up by each researcher. This enables each worker to set up his own schedule of temperatures, humidities and light exposures, including time of exposure to the various conditions.

Thus each laboratory can be used simultaneously for many experiments and by several workers, the only limitations being those of available space and in some rare cases the possibility of undesired crossbreeding. This system of operation does pose a bookkeeping problem since records of conditions and time of exposure to conditions must be kept for each plant. Thus, one of the important departments in the phytotron is the bookkeeping department.

The advantages of this method of use are illustrated by a successful experiment made to determine growing times of temperate climate plants. Exposure of the plants to 4 hours of equivalent daylight and 8 hours of darkness revealed that the plants would grow to maturity twice as fast as normal plants—each 24 hour day being converted into two growing days. This was done by moving the plants from laboratory to laboratory on a schedule.

The method of operation outlined requires that plants be grown on movable carts instead of conventional greenhouse benches. These carts are shown in Fig. 4. Each cart will hold six plants in gallon cans or four plants in two gallon crocks. The carts are moved from room to room by means of a small electric locomotive which pulls the carts around the building like a string of cars behind a railroad locomotive.

Cooling Requirements

The cooling required by the systems is generated by three reciprocating compressor units using Freon 12 refrigerant and equipped with water cooled condensers. One small greenhouse with a dark room and artificial light room is equipped with one of these condensing units, a 5 hp machine supplying a direct expansion coil to provide independent operation of this house. Those rooms, which can be maintained below 50 F if desired, are equipped with a 7½ hp condensing unit supplying refrigerant to three air conditioning units using direct expansion. This was done because in the lowest temperature rooms the refrigerant can at times be below the freezing point of water, which excludes the use of the main chilled water system.

The other laboratories are supplied with chilled water cooled by means of a 60 hp condensing unit supplying refrigerant to water chillers. The chilled water is stored in a 30,000 gal tank for a total capacity of 110 tons during any four hour period. The great diver-

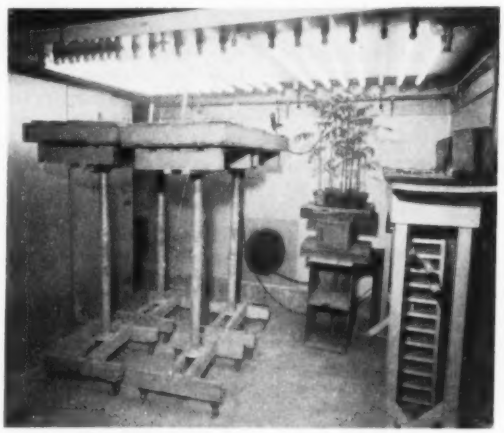


Fig. 4—Special carts for moving plants

sity of use of these laboratories indicated the requirement for a very flexible system, and chilled water was selected as the best answer to this requirement. Centrifugal pumps circulate the chilled water throughout the building at a rate of 150 gal per min (gpm) with a peak of 250 gpm. There the water is utilized by remote type air conditioners for each air conditioning system as required, and is also piped to supply and return outlets in each laboratory for use in root temperature and water bath experiments as desired.

Condenser water is supplied from a roof spray sytem, using water which has been allowed to flow over the roof of the greenhouses to accomplish sun radiation control in addition to supplying water for condensing. The condenser water is recirculated with centrifugal pumps and is passed through a sand and gravel filter after treatment by bromine to prevent algae growth. The rate of condenser water circulation is 195 gpm. At this rate an approach of 5 deg to the wet bulb temperature was obtained, though in addition to the condensing load, there is a load of approximately 90 Btu per square foot of glass roof due to absorbed direct and indirect radiation.

Heating Requirements

Heating is provided by two cast iron, gas fired boilers used as direct fired water heaters. Centrifugal circulating pumps circulate the hot water throughout the building where it is used as required by the remote type air conditioning units and it is also piped to each laboratory for root or water bath temperature experiments. The heating plant has no direct entrances or accessibility from the laboratory spaces, thus eliminating any possibility of contamination of laboratory air by products of combustion.

Steam for sterilizing is supplied by a small boiler. Tools, pots, and other hard goods are sterilized in a hospital type sterilizer with steam jacket or direct injection where possible. Plants are sterilized with triethylene glycol vaporized by a steam coil while sand, gravel, etc. are sterilized by direct steam injection through perforated pipes. It is interesting to note that even the cigarettes of the laboratory workers are sterilized.

Humidity Control

Humidity is controlled in three different ways. In the greenhouses, dehumidifiers with preheater coils control the dew point of the air and a reheater is used for temperature control. In the rooms where a 0 deg dew point can be maintained, if desired, a lithium chloride spray unit is used. In all other rooms the humidity is controlled by high pressure air atomization of a recirculating water spray.

Water used in the phytotron is treated in a de-ionizer to provide water free of bacteria and nearly as chemically pure as distilled water. The distribution system is of hard rubber and all storage tanks are of glass or are rubber lined to assure uncontaminated water at the point of use.

Sterilizing Laboratory Air

The sterility of the air is maintained (insofar as pollens, yeast molds and insects are concerned) by taking all outside air in at one source and electrostatically filtering at the outside inlet before introduction into the various systems. A circulating blower with static pressure control maintains the flow of treated air to all air conditioning units where outside air is required. The laboratory is under a positive air pressure at all times. There are only three weather stripped doors to the outside and all windows are sealed to prevent the entrance of contaminated air.

Nutrient (plant food) solution is mixed in a mixing and storage tank and is circulated throughout the building by means of a centrifugal pump to outlets in each room, where solution strength can be adjusted by dilution with de-ionized water and temperature can be adjusted with a chilled or warm water bath.

Compressed air of various pressures is supplied to each room from a central compressing unit. This air is for such general use as agitation and cleaning, and is taken from the discharge side of the electrostatic air filter.

In the course of working on the phytotron, many technical features of greenhouse air conditioning have been verified and can now be made available for use of design engineers. Some of these technical features are of use in general greenhouse design and some are at present only of use in the design of research greenhouses.

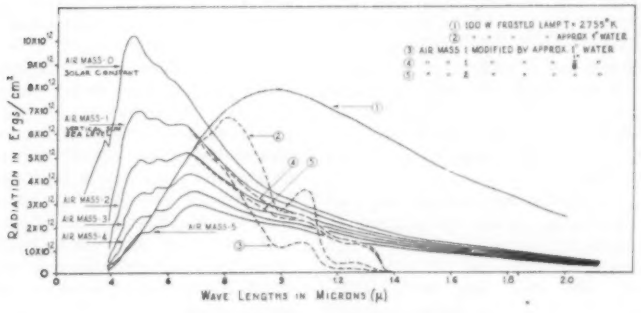


Fig. 5—Solar radiation distribution

Control of Radiation

The most important single factor in greenhouse design is *control of radiation*. It is important because the process of photosynthesis (the process by which plant life converts carbon dioxide and water vapor into

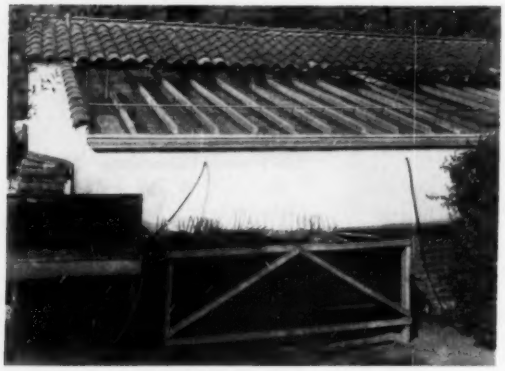


Fig. 6—Roof spray arrangement for part of laboratory

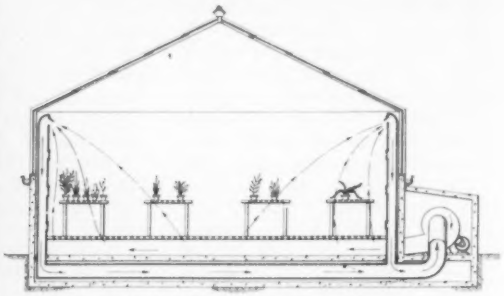


Fig. 7—Air distribution system for laboratory

carbohydrates) is dependent on sun light, the radiation from the sun. Studies of sun light indicate that a total of 1800 Btu per sq ft per 14 hour day or approximately 200 Btu per hour per sq ft at the mid-day peak will reach the average roof on an average mid-summer day in the temperate zone. Roughly 96 percent of this radiation will pass through a glass roof unless intercepted in some manner. It has been the custom to intercept much of this load by painting or shading the glass, but shading or painting unfortunately also reduces the rays from that part of the spectrum which are good for photosynthesis. Consequently, though temperatures can be held to levels which prevent plant damage, the growth of the plants will likewise be held to a low rate.

Further study has revealed that much of the sun's light is not used by plants and as a matter of fact even causes some plant damage. These non-usable rays are in the infrared portion of the spectrum. Experience has determined that a film of water 1/16 in. thick will remove 19 percent of the sun's rays and most of this percentage is infrared.

The solar distribution curves based on publications of the Smithsonian Institution illustrate this point with respect to the total radiation received from the sun by the earth's atmosphere (See Fig. 5). Note the effect of thickness of water in absorbing the radiation and also that practically no radiation of wave length above 1.3 microns (13,000 angstroms) is transmitted. This is all in the infrared band. Reflection from the two water surfaces and two glass surfaces, added to the amount of heat absorbed by the cooled under surface of the glass at normal wet bulb temperatures of 76 F or less, is about 25 percent. Thus, a total of 25 percent plus 19 percent or about 44 percent of radiation can be removed by the film of water on the glass surface.

These facts, verified in the laboratory, show that a water film will allow the plants to grow at close to the normal rate of growth while holding temperatures at an even lower level than painting or shades (and it is well known that painting or shading of the glass will practically stop growth.) In the phytotron there is a saving of about 275,000 Btu per hour on the cooling load by use of the water film. Since most glass roofs are sloping, the water can be sprayed on near the ridge and allowed to flow down the glass (Fig. 6). At the phytotron, double use of this water is made—it is the condenser water and also a radiation shield. A circulation of about 1½ gpm minimum per foot of glass width seems to give good coverage.

So great is the radiation load on greenhouses that for cooling of plants of tropical, subtropical and temperate climates, the only cooling load that need be normally considered in the design calculations is the radiation load. All interior surfaces in greenhouses should be painted with aluminum paint to give as equal a distribution of radiation as possible. The roof spray water must also be properly treated for control of scale and algae.

Another important environmental condition is temperature. Whether the plant flowers properly and bears good fruit is almost entirely dependent on a proper range of temperatures at some time during the life cycle for annuals or reproduction cycle for perennial plants. However, it is impossible to set up design temperatures for plants since each plant will require a different condition.

The engineer should check the native habitat of the plant for the conditions best suited to the plant. His design should include provisions to reproduce proper day and night conditions (the night conditions being the most important since actual growth occurs at night and the rate and quality of growth and fruit production are determined by night conditions).

The designer should avoid using design conditions set up by nurserymen who have not determined the plant's native environment. Nurserymen base their data on information gained as a result of experience but without observing the thermometer, and though most nurserymen may feel that proper conditions for plant growth exist, they fail to relate their experience to the actual scientifically determined conditions.

Except for certain plants such as the succulent family, which grows under extreme humidity conditions, humidity is not so important to most plants as was originally thought. Desired humidity design conditions should be determined as carefully as the desired temperature conditions. In the study of humidity effects, one family of plants was found sensitive to relative humidities exceeding 75 percent. This plant had a leaf with a practically vaporproof top; the underside of the leaf absorbed moisture from surrounding air when the relative humidity exceeded 75 percent but closed its moisture absorbing units in the leaves to prevent loss of moisture due to reverse action when the relative humidity fell below 75 percent. Planted on the desert in quantity, this plant could absorb moisture during nights when the desert temperature usually approaches the dew point and thus ultimately make the desert bloom by feeding the plant roots and indirectly the soil with moisture removed from the air during times of high relative humidity.

Control of Air Flow

Air distribution is a very important design factor. In most greenhouses the combination of a high radiation load, a relatively low temperature and moderately high humidity combine to require high air volumes, usually in the range of a one minute air change. At the phytotron the change occurs in 20 to 40 seconds. Further, since overhead distribution casts shadows and because plants do not like drafts, low air inlets and high air outlets are desirable. This upward moving air containing water vapor will also remove some long wave length radiation before it reaches the plants. At the phytotron, workers experimented with, and are now using, a unique method of air flow through the floor using a plenum space under the floor with air inlet slots through the floor (Fig. 7). Slots should be ¼ in. or less in width, and velocities up to 2000 fpm can be used with good results. In operation now are several greenhouses using slots in the floor with good results.

Many other factors are still under study. In the meantime, the air conditioning profession should keep an eye on this type of research not only for its benefits to mankind, but also for its interest to engineers because they will be called in to design huge seed production greenhouses and many large greenhouses in which luxury crops will be produced regardless of season.

PRESIDENT'S LETTER

Dear Fellow Members of ASHVE:

Greetings from your officers for 1950. This letter is inspired by a sentence just read while riding the Shasta Daylight between meetings with the Golden Gate Chapter and the Oregon Chapter. The sentence reads:

> "they want to know about . . . policies and problems, and they want to know top management. They are suspicious when left in the dark. . . ."

Right now many of our members are concerned over the implications of the new By-Laws. It is possible there are many who question the effect of the By-Laws. May I offer this word of explanation.

At the Meeting of Council Thursday afternoon at Dallas, authorization was given to the Executive Committee (present officers) to study our operations so that they could be brought into line with the new By-Laws. This study will include the use of present and special committees to study different phases of our activities, prepare Rules and submit reports and Rules to Council for approval and implementation. Until such Rules are adopted by Council your Executive Committee can make no change in operations.

Executive Committee meets in Cleveland, February 19th and again in March and again prior to next Council meeting, which will be about the 15th of April. Any member, any Chapter, any Committee or group that has any suggestions to make as to operations under these By-Laws is asked to write Secretary Hutchinson for presenting to Executive Committee for consideration.

It is not necessary, nor desirable, at this time for various groups to go to the trouble of trying to prepare amendments to the By-Laws. I have had the opportunity since leaving Dallas of carefully studying these By-Laws and find some items to question. The other officers are also studying. Give us your suggestions, informally or formal, but give us a chance through the proper channels to work up a program of procedure and, if amendments are needed, we will offer them for Society approval.

Your President and other officers wish your suggestions at any time not only about By-Laws but other questions of policy and program so that we may make this a stronger Society, better serving its membership and the general public.

Sincerely,

LESTER T. AVERY, *President*

February 13, 1950

JOURNAL SECTION

Solar Heating of Houses by Vertical South Wall Storage Panels

By Albert G. H. Dietz* and Edmund L. Czapek**, Cambridge, Mass.

SUMMARY—This paper reports the results of one full heating season's experiments (Cambridge, Mass., 1947-1948) with solar heat collectors and heating units. These consisted of black-surfaced, water-filled containers situated behind two and three sheets of glass to form the south-facing, solar heat storage wall of a small test house. It was found that excessive heat losses outward from the collector surface made auxiliary heating necessary. Efficiency of the solar heating unit increased when the storage function was removed from the heat collecting function.

PREVIOUS work on solar heating of houses has been reported by Hottel and Woertz[1] and by Telkes[2]. In the present test house, the system was simplified by combining the collecting, storing and heating functions in one simple container. For the winter season, the flat-plate collector can be vertical and be nearly as effective as if it were inclined at the most favorable angle to the sun. It was decided, then, to use a vertical south wall, with water as the heat-storing medium.

Experimental Procedure

The test house or laboratory has been previously described[3]. Fig. 1 shows the exterior, and Figs. 2 and 3 are the plan and cross section of the house. The solar energy collecting walls (Fig. 2) were oriented due south. The building contained seven test cells, an instrument room, and a guard room (Figs. 2 and 3).

All doors were heavy refrigerator-type doors. The instrument room and the guard room were kept at 70 F and therefore helped to prevent appreciable heat losses through the side walls of test cells 1 and 7. Because the construction was well insulated and because the number of air changes in the test cells was small, the north walls of test cells 2 and 3 were provided with blackened copper panels or heat leaks through which enough heat would be lost to raise the overall coefficient of heat loss of these two test cells to a figure similar to that of the usual well-insulated house under normal conditions of use.

The solar energy or storage wall units shown in Fig. 4 comprised the south wall and combined the functions of collection, storage, and heating the interiors of the test cells. In test cells 1-6 the south walls consisted of a commercial double glass; edge-sealed, 7/32-in. thick, ½-in. air space, figured glass. In test cell 7 the south wall was triple glass of similar manufacture. Figured glass was chosen because it is considerably less costly than plain or plate glass.

Behind the glass walls were water-filled containers consisting of standard 1 gal and 5 gal cans. The 1 gal cans provided a 4-in. thickness and 9-in. height. The 5 gal cans provided a 9-in. thickness and 9-in. height. Cans were laid up to fill completely the space behind the glass, and were supported at 18-in. intervals in height by wooden shelves to prevent excessive loads on the lowermost cans. The joints between cans, and the vertical joints between cans and window frames were sealed with tape to prevent air leakage. Outer faces of cans were painted a matte black to absorb the highest possible percentage of incident solar radiation. Inner faces were painted white.

At night, double aluminum-painted roll curtains with a ¾-in. air space between the layers were drawn between the glass and the containers to reduce outward heat losses. Curtains were up during the day for the eight hours of usable sunlight, and drawn the rest of the time.

The end test cell, number 1, had no solar energy collection units, but it did have a double aluminum-painted curtain similar to the other test cells. It was used as a basis of comparison with the other six test cells and also with the usual *solar house* which allows the sun's energy to pour through south-facing glass walls in the daytime, but makes no attempt to store that energy ex-

Fig. 1—Exterior of test house showing south wall

Test cell at left has no storage units. Adjacent six cells have various arrangements of storage units. End three windows are in office space. Aluminum-coated curtains drawn in all cells except cell at left. Horizontal pyrheliometer is mounted on roof and measurements of diffuse radiation are being made.

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[1]Exponent numerals refer to Bibliography.

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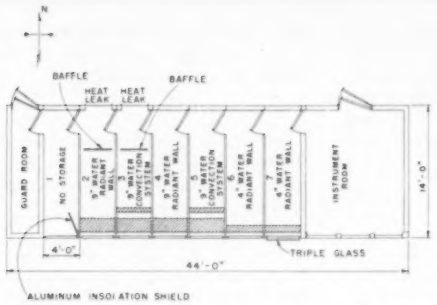

Fig. 2—Plan of test house showing arrangement of test cells

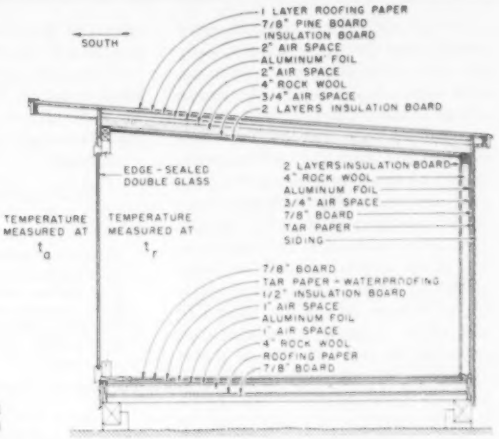

Fig. 3—Cross section of test house showing construction

cept by absorption in floors, walls, and furnishings.

To maintain the temperature of the test cells at the desired level (70 F), radiation was controlled, (Fig. 4A) by raising and lowering the inner curtain. Forced convection was obtained by a 6-in. blower, (Fig. 4B) which drew room air through an opening near the bottom of an insulated wall interposed between the containers and the test cell, blew the air upward along a baffle, past the inner surfaces of the containers, down the other side of the baffle, and out into the test cell at the floor level. Radiation systems were used in test cells 2, 4, 6, and 7; forced convection systems in test cells 3 and 5.

Auxiliary electrical heaters of the sunbowl type—574 w average measured capacity—were placed in the test cells to keep the temperature at the proper level if the solar energy units failed to do so.

A stratification test showed temperature differences as high as 11.7 F in the quiet air of the test cells. Consequently, 4-in. fans were placed in the test cells to keep the air moving. They were found ample to keep temperature differences in the test cells below 1 F.

Additional electrical units were: the convection blowers in test cells 3 and 5; the motors for raising and lowering the inner shades in test cells 2, 4, 6 and 7 (outer shades were drawn by hand, but could have been drawn automatically); and miscellaneous electrical control components such as transformers and relay coils.

Two systems of temperature control within the test cells were employed. The first, employed during December and January had two bimetallic thermostats: (a) for the heater and (b) for the operation of the inner curtain or blower. Each operated on a temperature differential of 0.5 F between open and closed positions. This system was not entirely satisfactory. A second system of controls was therefore put into effect during February, March, and April. It involved controls based both on room temperature and on storage wall temperature.

The upper control temperature was increased to 72 F because the motors of the air-circulating fans gave off enough heat to raise the temperatures of the test cells approximately 2 deg. The lower control temperature was raised to 70 F for the same reason, and because 65 F to 67 F was considered to be uncomfortably cool.

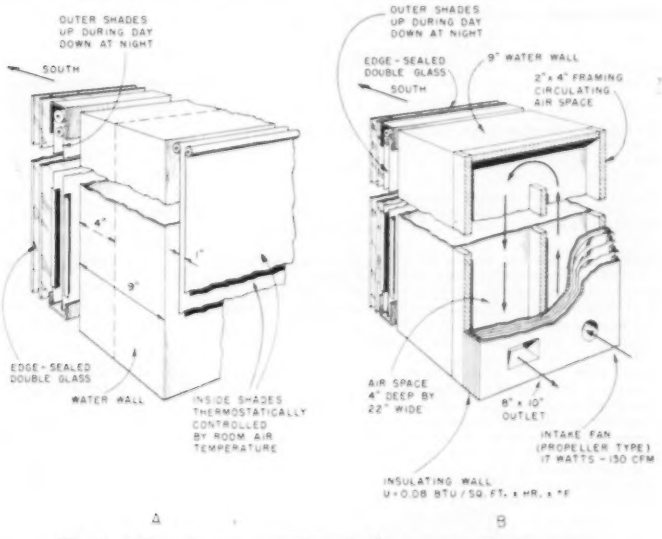

Fig. 4—Schematic representation of solar energy collecting units

In test cell 1 no controls were placed upon the upper temperature. The room was allowed to overheat, as it might in the usual *solar house* unless shades or drapes were drawn or windows were opened. The lower temperature level of 70 F was maintained by the sunbowl heater.

As shown in Fig. 2, baffles were placed in test cells 2 and 3 to prevent direct radiation between storage walls and inner cold surfaces of the blackened copper heat leaks. An aluminum shield was placed in test cell 1 to protect the side-wall adjacent to test cell 2 from direct sunlight. Because test cell 1 overheated, there was some heat penetration through the partitions to test cell 2. This was calculated, and allowance was made for it in the heat balance on test cell 2.

Heat-Loss Coefficients

The heat-loss coefficients for the double and triple glass were first theoretically calculated by the method of Hottel and Woertz[1]. Several night-time tests were subsequently run in test cell 1, and the electrical power necessary to maintain a temperature of 70 F inside the test cell was measured at the same time that measurements were made of the interior temperature, temperatures of the air space between the glass and the drawn double aluminum curtain, and the outdoor temperature. From the measured temperature drop from the shade-window air space to the outdoors and the theoretically calculated double glass window thermal coefficient, the heat loss during the test runs of the south window (area of 32.2 sq ft) was determined. This south window heat loss subtracted from the total electrical equivalent heat loss of the cell yielded, when divided by the overall temperature drop of inside to outside air, an averaged thermal coefficient for the ceiling, north wall, and floor (area of 136.9 sq ft). It will be referred to as an *experimental value*, in contrast to the *theoretical* value involving no measurements.

In test cells 2 and 3 the heat-loss coefficients for the heat leaks were determined from: measured temperature drops from inside air to copper and from copper to outside air; assumed inside surface coefficient based on free convection; and area of copper surface. For heat flow through two parallel heat resistances

$$\frac{t_i - t_o}{t_i - t_l} = \frac{h_i}{h_o} \quad \ldots\ldots (1)$$

where

t_l = temperature of heat leak
t_o = outdoor air temperature
t_i = indoor air temperature
h_i = interior surface thermal coefficient, assumed equal to 2
h_o = outside surface thermal coefficient

Utilizing the relation

$$U_l = \frac{h_i}{1 + \frac{h_i}{h_o}} \quad \ldots\ldots (2)$$

where U_l = heat-loss coefficient for the heat leak, the required equation becomes

$$U_l = \frac{2}{1 + \frac{t_i - t_o}{t_i - t_l}} \quad \ldots\ldots (3)$$

The product $U_l A_l$ (heat-loss coefficient times the area of the heat leak) was determined and added to the similar product, UA, of the floor, north wall, and ceiling exclusive of the heat-leak area, assuming the value U for cells 2 and 3 to be the same as that determined for cell 1. From the sum $U_l A_l$ plus UA the overall heat-loss coefficient for the floors, north walls, and ceilings of test cells 2 and 3 was determined.

The heat-loss coefficients so obtained are shown in Table 1.

Measurements

During the period of operation of the laboratory, measurements were made and continuous records kept of the following:

1. *Temperature: a.* Room air temperature of test cells 1-7, inclusive; *b.* Average mid-wall temperature of storage walls in test cells 2-7, inclusive; *c.* Average inside surface temperature of the copper window heat leaks—test cells 2 and 3; *d.* Outside air temperature.
2. *Solar Energy: a.* Horizontal incidence; *b.* Vertical incidence.
3. *Electrical Energy: a.* Electrical input into each room; *b.* Time of heater operation in each room.

Temperatures were recorded with copper-constantan thermocouples. Storage wall temperatures were the average of 10 points at mid-wall. Occasional measurements were also made of the inside and outside surfaces of the storage containers by means of four thermocouples on each surface. These surface temperatures were found to differ by not more than three degrees during periods of maximum solar radiation, and to differ inappreciably during periods of no radiation.

Intensity of solar radiation was measured by two Eppley pyrhelio-

Table 1—Average Thermal Coefficients

	Theoretical Btu/(sq ft) (hr) (F deg)	Experimental[a] Btu/(sq ft) (hr) (F deg)
Double glass window alone (at average temperature level of 60 F)	0.61	
Double glass window alone (at average temperature level of 35 F)	0.51	
Double glass window alone when part of a glass and curtain combination (at average temperature level of 35 F)	0.57	
Double aluminum curtain alone (at average temperature level of 55 F)	0.24	0.84
Double glass window in combination with double aluminum curtain (at average temperature level of 50 F)	0.17	0.34
Double glass window in combination with double aluminum, and film resistance of collector surface (at average temperature level of 54 F)	0.155	0.29
Triple glass window alone (at average temperature level of 35 F)	0.345	
Triple glass window when part of a glass and curtain combination (at average temperature of 35 F)	0.36	
Triple glass window in combination with double aluminum curtain (at average temperature of 50 F)	0.145	0.25
Triple glass window in combination with double aluminum curtain and film resistance of collector surface (at average temperature of 54 F)	0.135	0.22
Floor, north wall, ceiling (test cells 4, 5, 6, 7)		0.056
Floor, north wall, ceiling (test cells 2, 3)		0.116

[a] At average overall temperature difference (inside room or collector surface to outside air) of 40 F.

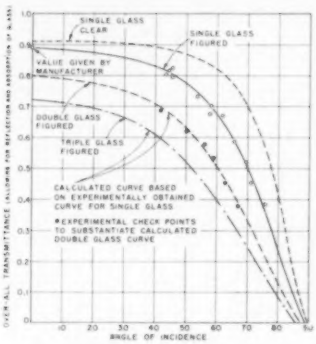
SINGLE GLASS CLEAR
SINGLE GLASS FIGURED
VALUE GIVEN BY MANUFACTURER
DOUBLE GLASS FIGURED
TRIPLE GLASS FIGURED
CALCULATED CURVE BASED ON EXPERIMENTALLY OBTAINED CURVE FOR SINGLE GLASS
*EXPERIMENTAL CHECK POINTS TO SUBSTANTIATE CALCULATED DOUBLE GLASS CURVE
OVER-ALL TRANSMITTANCE (ALLOWING FOR REFLECTION AND ABSORPTION OF GLASS)
ANGLE OF INCIDENCE

Fig. 5—Transmission curves of clear and figured glass

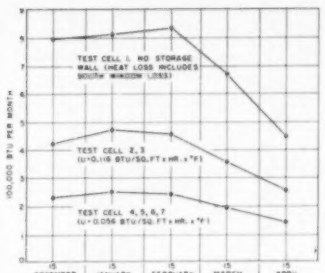
TEST CELL 1, NO STORAGE WALL (HEAT LOSS INCLUDES SOUTH WINDOW LOSS)
TEST CELL 2, 3 (U=0.116 BTU/SQ.FT.x HR. x °F)
TEST CELL 4, 5, 6, 7 (U=0.056 BTU/SQ.FT.x HR. x °F)
100,000 BTU PER MONTH
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL

Fig. 6—Monthly heat loss of test cells, not including outward heat loss of collectors

meters mounted horizontally and vertically on the roof of the building. Continuous records were kept on recording potentiometers.

The amount of solar radiation transmitted through the figured glass, was calculated from: (1) direct radiation from the sun; (2) diffuse radiation from the sky; (3) experimental determination of the transmissivity of the figured glass at various angles of incidence.

Spot readings of diffuse radiation were made at intervals nearly every day by shading the target of the vertical pyrheliometer for approximately two minutes by a disc of 4.5 in. diameter held 10 disc diameters distant. On days when spot diffuse readings were not available, diffuse values were taken from the solar charts from low points caused by clouds eclipsing the sun temporarily. Diffuse values so found were fairly constant at 30 to 40 Btu per sq ft per hour during the heating season. The higher values occurred during periods of high reflection from freshly fallen snow.

Transmissivity of figured glass was found to average 10.8 percent less than that of clear glass, the actual value depending upon the angle of incidence as shown in Fig. 5. The overall average transmittance for sunlight of a system of two figured glass plates (allowing for both reflection and absorption at various angles of incidence) was: October—0.58; November—0.64; December, January, February—Average 0.64; March—0.53; April—0.47.

Test Results

Monthly heat losses from the various test cells are shown in Fig. 6†. Test cell 1 lost heat through the south window in addition to floor, north wall, and ceiling. The others lost heat essentially only through floor, north wall, and ceiling. The high heat losses from test cell 1, whose construction except for storage walls was the same as 4, 5, 6, and 7, were occasioned by the absence of the storage wall and the considerable amount of overheating which occurred during the daytime.

Fig. 7 presents data on vertical incidence of solar energy for the period November—April. This was an exceptionally snowy winter in Cambridge, and the period of heaviest snowfall during January was accompanied by markedly reduced sunlight, as the figure shows. The three-month average vertical incidence for December, January, and February was 945 Btu per sq ft per day, of which 270 were vertical diffuse. The average transmitted and absorbed energy with double and with triple glass was 605 and 530 Btu per sq ft per day respectively.

Of the 182 days, the percentages having vertically incident radiation greater than 2000, 1500, 1000 and 500 Btu per sq ft per day are shown in Table 2.

Table 2—Distribution of Daily Solar Incidence

Solar Incidence Btu per sq ft per day	Occurrence days	Occurrence, Percent of Total Number of Days
Greater than		
2000	6	3
1500	41	23
1000	83	46
500	118	65

If all of the transmitted and absorbed solar energy had been available to heat the interiors of the test cells, there would have been more than enough to keep all of them except test cell 1 at 70 F (Table 3). A large proportion of the energy was lost outward through the glass, both in the daytime when the outer curtains were up, and at night when they were drawn.

The net solar input was derived by two methods:

1. By finding the difference between the transmitted-and-absorbed solar energy (S'_{TH}) and the calculated outward heat loss (Q_C) from the collector surface

2. By finding the difference between the total heat loss from the test cell exclusive of window losses (Q_W) and the measured electrical input (Q_E).

†In Figs. 6-8, the totals for the months are plotted on the 15th day. The connecting lines are for convenience in following trends.

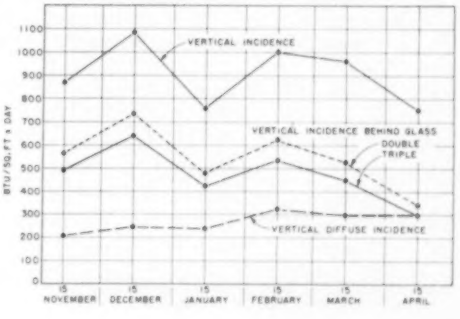

Fig. 7—Average monthly value of daily solar incidence. (Cambridge, Mass. 1947-1948)

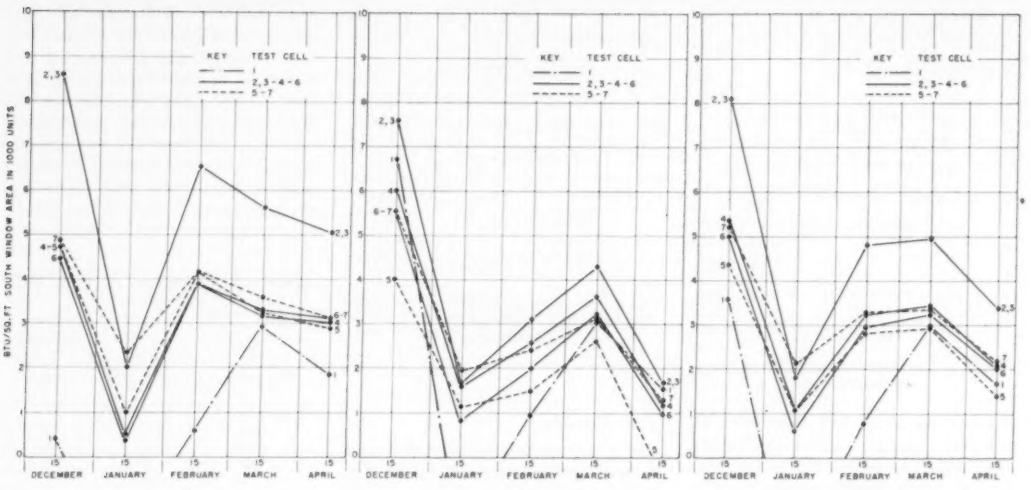

Fig. 8—Monthly net solar energy gain obtained by difference between (A) Total heat loss and electrical input; (B) Transmitted and absorbed vertical solar input and outward heat losses from collector surfaces; (C) Average of A and B

These two values should be the same:

$$S'_{VM} - Q_C = Q_W - Q_E \ldots\ldots (4)$$

Actually, the two methods differed from month to month, as was to be expected of methods which depend upon finding a relatively small difference between two fairly large numbers, as is true of both sides of the equation. The difference was largest in April when the heating requirement was the smallest. For the five-month period the two methods differed by 15.8 percent. Figs. 8A and 8B give the net solar input derived by the two separate methods, and Fig. 8C gives the average of the two. Because the chances of error are about equal in the two methods, the average values are employed in the subsequent discussion.

Fig. 9 is a cumulative plot of the total solar incidence, the proportion transmitted through two glass plates and absorbed by the collector surface, the proportion lost outward, and the net energy available for house heating. Because test cells 2 and 3 had similar net inputs, they are averaged together on Fig. 9 as condition C. Test cell 6 represents condition A, and test cell 4, condition B.

The outward losses are the differences between the solar energy transmitted and absorbed (S'_{VM}), and the net solar inputs into the various test cells. The importance of the outward losses is emphasized by Table 3. Because there was no practicable way of eliminating all convection losses around the double curtains, and because the theoreti-

Table 3—Summary of Energy Losses and Gains per Square Foot of Collector Area
(December-April, Inclusive)

Test Cell	S'_{VM} Solar Energy Transmitted and Absorbed	Outward Losses from Collector Surface		Solar Input into Test Cell[a]		Heat Requirements		
	1000 Btu	1000 Btu	% of S'_{VM}	1000 Btu	% of S'_{VM}	1000 Btu	% of S'_{VM}	Percent Gained from Sun
1	78.4			78.4[b]	100.0[b]	116.1[b]	148.1[b]	67.5[b]
		72.6	92.6	5.8	7.4	43.5	55.5	13.3
2,3	78.4	55.4	70.6	23.0	29.4	61.2	78.0	37.6
4	78.4	63.2	80.6	15.2	19.4	32.6	41.6	46.6
5	78.4	65.8	83.9	12.6	16.1	32.6	41.6	38.7
6	78.4	64.6	82.4	13.8	17.6	33.4	42.6	41.4
7	67.7	51.6	76.2	16.1	23.8	33.4	49.4	48.2

[a]Average of two methods of measuring net solar input.
[b]Based on total heat loss area (including south window). All other values are based on floor, north wall, and ceiling area only.

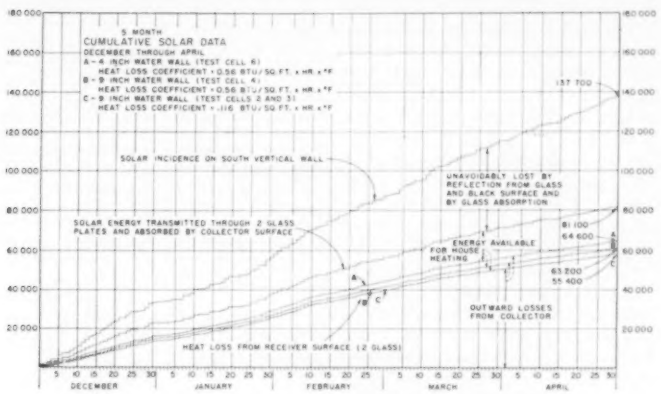
5 MONTH
CUMULATIVE SOLAR DATA
DECEMBER THROUGH APRIL
A - 4 INCH WATER WALL (TEST CELL 6)
HEAT LOSS COEFFICIENT = 0.56 BTU/SQ FT. x HR. x °F
B - 9 INCH WATER WALL (TEST CELL 4)
HEAT LOSS COEFFICIENT = 0.56 BTU/SQ FT. x HR. x °F
C - 9 INCH WATER WALL (TEST CELLS 2 AND 3)
HEAT LOSS COEFFICIENT = .116 BTU/SQ FT. x HR. x °F
SOLAR INCIDENCE ON SOUTH VERTICAL WALL
137 700
UNAVOIDABLY LOST BY REFLECTION FROM GLASS AND BLACK SURFACE AND BY GLASS ABSORPTION
SOLAR ENERGY TRANSMITTED THROUGH 2 GLASS PLATES AND ABSORBED BY COLLECTOR SURFACE
81 100
64 600
ENERGY AVAILABLE FOR HOUSE HEATING
63 200
55 400
OUTWARD LOSSES FROM COLLECTOR
HEAT LOSS FROM RECEIVER SURFACE (2 GLASS)
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL

Fig. 9—Cumulative solar data for five months December-April

cal efficiency of the aluminum coating of those curtains was not attained in a practicable installation, the actual overall heat-loss coefficients were high, as shown in Table 1, and the outward heat losses ranged from one and one-half times to two times as high as the theoretical losses. As can be seen from Table 3, the consequence was that on the average less than half the heat requirements of the test cells were supplied by the sun.

As shown by Table 4, if heat storage were separated from heat collection, so that outward losses from the collector surfaces would be confined to the daytime when the collector surfaces were warm, with night-time losses all but eliminated, the efficiency of the system could be greatly improved.

Test cell 1, the cell which had only the double glass plus double curtain, provides an interesting comparison with the storage-wall cells. As shown in Table 3, the total heat requirements of this cell were 116,100 Btu per sq ft of south wall area, of which 43,500 Btu represented the losses through the floor, north wall, and ceiling, and the balance, the losses through the glass and curtains. Because all of the transmitted and absorbed energy reached the interior of the cell, the net gain to the cell as a whole was 100 percent of this energy figure, or 67.5 percent of the total heat requirements of the cell. The outward losses through glass, however, were 72,600 Btu per sq ft of south glass, leaving a net gain of only 5,800 Btu per sq ft of south glass or 13.3 percent of the requirements of floor, north wall, and ceiling. The total heat requirement was 148.1 percent of the transmitted and absorbed energy, so that even with a double curtain plus double glass of 100 percent efficiency, the total requirements could not have been met.

The solar gain of test cell 1 was obtained mostly by allowing the test cell to overheat. If the temperature had been maintained at a level of 70 F as in the other cells by ventilation or shading, the heat loss of cell 1 exclusive of the south window would have decreased from the overheat condition, 43,500 Btu per sq ft of south window, to 39,500. The 4,000 Btu due to overheat when compared with the 5,800 Btu actually gained shows that a large part of the gain would disappear if the overheating were eliminated. It appears, thus, that the net solar gain of a double glass south wall plus a double aluminum curtain drawn at night is slight, if

Table 4—Collector With Remote Storage

(Energy Gains, Losses, and Heat Requirements Cambridge, Mass., Dec. 1947-April 1948)

(1000 Btu per Sq Ft of Collector Area)

Test Cell	2-3	4	5	6	7
Transmitted and Absorbed Energy	78.4	78.4	78.4	78.4	67.7
Daytime Losses	30.2	31.8	34.6	33.1	24.5
Night-time Losses	4.5	4.8	5.2	5.0	4.4
Net Gain	43.7	41.8	38.6	40.3	38.8
Total Heat Requirement	61.2	32.6	32.6	33.4	33.4
Percent of Heat Requirements	71.4	128.0	118.0	120.5	116.0

Table 5—Average Monthly Temperatures and Mean Deviations (F)

t_r = test cell temperature (with mean deviations) t_c = container temperature t_o = outdoor temperature

Test Cell		1	2	3	4	5	6	7
December	t_r	74.2±10.6	68.1±1.9	68.1±1.5	69.1±1.6	68.9±1.0	70.8±2.7	70.8±2.8
(t_o = 29.8)	t_c		79.4	79.7	83.8	89.1	85.1	89.8
January	t_r	69.5±6.8	66.4±1.2	66.2±0.9	66.5±1.1	66.7±1.4	66.8±1.7	67.0±2.1
(t_o = 22.9)	t_c		68.3	68.7	68.7	70.0	70.7	73.5
February	t_r	76.8±8.3	71.6±1.0	71.4±0.9	71.6±0.9	71.7±0.9	71.7±1.2	72.1±1.4
(t_o = 26.6)	t_c		79.0	78.9	80.4	83.5	81.9	86.5
March	t_r	76.9±8.5	72.2±1.7	71.6±1.0	72.3±1.6	72.4±1.3	73.3±2.6	73.7±2.7
(t_o = 38.9)	t_c		80.0	80.6	82.0	85.1	83.5	87.4
April	t_r	75.2±6.3	72.4±1.8	71.9±0.9	72.8±1.5	72.5±1.1	73.8±2.3	74.1±2.4
(t_o = 48.1)	t_c		80.2	81.1	82.2	86.2	82.9	85.5

at all existent. The psychological effect of a large south-facing glass area in winter is generally excellent and this may well be its principal asset.

Temperatures

Further insight into the behavior of solar units is gained from the record of temperatures attained in the storage walls in relation to indoor and outdoor temperatures. Table 5 sets forth the average monthly indoor and outdoor temperatures and the average temperatures attained by the containers for the period December—April. The maximum and minimum values are given in Table 6.

During December and January, which were the periods of the first system of controls, the average cell temperatures were somewhat lower than during the period February—April, when the second system of controls was in operation. The collector temperatures in cells 2 and 3, which had the heat leaks, were generally lower than in the rest of the cells, although the difference between these two cells and cells 4 and 6 was not great. Collector temperatures in cells 5 and 7 were in general appreciably higher than in the other cells. Cell 7, with triple glass and 4-in. containers attained the highest temperatures. Under January's abnormally poor solar conditions, there was little difference among cells 2 to 6, and even cell 7 was not markedly higher than the others.

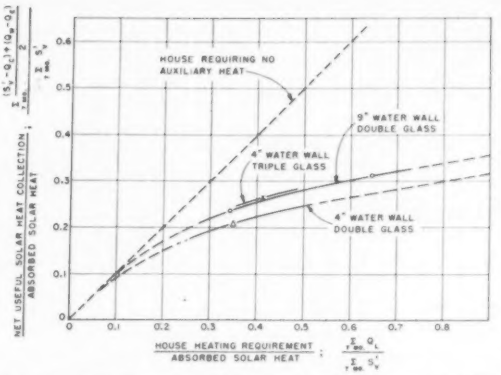
HOUSE REQUIRING NO AUXILIARY HEAT
9" WATER WALL DOUBLE GLASS
4" WATER WALL TRIPLE GLASS
4" WATER WALL DOUBLE GLASS
NET USEFUL SOLAR HEAT COLLECTION ÷ ABSORBED SOLAR HEAT
HOUSE HEATING REQUIREMENT ÷ ABSORBED SOLAR HEAT

Fig. 10—Design curves, solar energy utilization *vs.* heating requirements

Table 6 shows that peak temperatures of approximately 105 F to 110 F were occasionally found in the 9-in. containers, (cells 2 and 5) and that the 4-in. containers (cells 6 and 7) occasionally rose to above 120 F. In spite of these peaks, the average monthly temperatures in no instance exceeded 90 F (Table 5), and for the 9-in. containers generally ran below 85 F. As was to be expected, the greatest fluctuation between maximum and minimum temperatures occurred in the thinner (4-in.) containers. April showed a marked drop in maximum temperatures because the angle of incidence became large (approximately 55 to 60 deg at noon.)

Although this installation employed water walls, the results are applicable to other heat storage media, because the percentage collection is determined by the temperature of the collector as that affects outward losses, and the average wall temperatures of 80-90 F or less are about as low as are practicable. Consequently, the use of any other wall, either thicker or different, could not produce any marked decrease in outward loss and therefore any marked increase in performance. This is particularly true of Glauber's salts or other fusible materials having melting points in the vicinity of 90 F. The results, then, may be considered applicable to any heat storage medium.

Table 6—Maximum and Minimum Wall Temperature (F)

Room	1	2	3	4	5	6	7
December							
Max.		96.0	97.0	102.0	109.5	118.5	121.0
Min.		62.0	62.0	62.5	63.5	57.5	62.0
January							
Max.		91.0	93.5	93.0	97.5	114.0	116.0
Min.		57.5	57.0	57.5	57.5	56.0	59.0
February							
Max.		98.0	97.5	101.0	104.0	119.5	121.5
Min.		66.5	66.0	66.0	68.5	61.5	65.5
March							
Max.		98.0	97.0	108.5	102.0	122.5	124.5
Min.		65.5	65.0	63.0	65.5	61.0	65.5
April							
Max.		92.0	94.5	94.5	104.0	104.0	104.5
Min.		67.0	67.0	67.5	69.0	63.5	66.5

Conclusions

1. The attractive simplicity of the south-facing storage wall, (combining collection, storage, and heating) is offset by the excessive heat losses outward from the collector surface which is warm at all times and therefore loses heat whether collecting heat or not. To make this system feasible, a practicable way must be found of decreasing materially the outward losses during periods when the sun is not shining.

2. The thicker the storage wall, the better its performance, but increasing the thickness 2¼ times as in this experiment (4-in. *vs.* 9-in. water walls) does not increase the efficiency proportionately. Increasing the thickness still more or changing the type of storage medium would have little effect.

3. The greater the heat requirement, the greater the efficiency of the storage system in terms of net solar gain. The two cells with the heat leaks gained 29.4 percent of the transmitted and absorbed solar energy, compared to 19.4 percent for the similar cell without

heat leak. The energy gained, however, is a smaller proportion of the total requirement of the more poorly insulated structure as compared with the well-insulated structure.

4. Triple glass in place of double glass increases both the net solar gain and the gained proportion of the total heat requirement. The increase is about 15 percent as evidenced by the 41.4 percent of total heat requirement gained by the 4-in. wall with double glass as compared with the 48.2 percent gained by the similar wall with triple glass. The 4-in. wall with triple glass is approximately the same as the 9-in. wall with double glass.

5. When heat requirements are appreciable, (as in cells 2 and 3) there is little difference between the radiant method and the convection method of transferring heat from the storage wall to the room.

6. Outward losses with the storage wall system range from 70 to 84 percent of the transmitted and absorbed solar energy. The percentages of total heat requirements supplied by the storage walls range from 38 to 48 percent; consequently, more than one-half to six-tenths of the total heat must be supplied by auxiliary sources.

7. If remote storage is substituted for the storage wall approximately 70 to 130 percent of the total heat requirements can be supplied by the sun, but periods of several days of little or no sun (as occurred in January) may deplete the system to the point where auxiliary heat is required in any event.

8. In spite of the relatively low performance of the storage wall, it is better than the no-storage wall. The no-storage wall does show some net gain but it is small compared with the storage wall. The psychological effect, on the other hand, may well be in favor of large south-facing glass areas.

Design Curves

Curves which permit some measure of design of storage walls have been drawn on the basis of the performance of the 4-in. and 9-in. thick storage walls (Fig. 10). In these curves the ordinate is the fractional savings calculated by placing in the numerator net useful solar heat gain during the heating season and in the denominator the total transmitted and absorbed solar energy during the same period. The abscissa is the ratio of the house heating requirements to the transmitted and absorbed solar energy, also during the heating season.

If no auxiliary heat were to be required, the storage wall performance should fall along the diagonal line. The actual performances of the 9-in. walls with double glass for heat loss coefficients of 0.116 and 0.056, and of the 4-in. wall with triple glass, are plotted, and a curve is drawn. The performance curve of a 4-in. wall is estimated on the basis of the single point for 4-in. wall and double glass and the shape of the curve for 9-in. walls. If, then, a house were to be designed for a ratio of house heating requirement to absorbed solar heat of 0.3, a house requiring no auxiliary heat would require a ratio of net useful solar heat collection to absorbed solar heat of 0.3. The 9-in. wall with double glass would provide 0.225 or 75 percent of the total requirement, leaving 25 percent to be supplied by auxiliary heat. It can be seen that the smaller the ratio of house heating requirement to absorbed solar heat, the more nearly the storage wall will provide complete heating even though the ratio of net useful solar heat collection to absorbed solar heat becomes smaller at the same time.

These design curves have not been carried further because enough evidence has been accumulated to indicate that the system of south wall heat collection should not be employed without modification. The outward heat losses are so large that high efficiency cannot be expected.

If the wall thickness were greatly increased, or if a storage medium of very large heat capacity were employed, no major net gain in heat collection could be expected because a certain wall temperature must be maintained to carry on the mechanism of heat exchange from the storage system to the room. This temperature level fixes the outward heat losses and also limits the heat capacity of the system because the heat capacity must be small enough to allow the solar input to raise the temperature to the necessary level. The conclusion is therefore reached that significant increases in efficiency can be attained only by removing the heat storage function from the heat collecting function, so that excessive outward heat losses can be markedly reduced. In the subsequent work carried out as a part of this project, the collection and storage functions have been separated.

Acknowledgments

The authors gratefully acknowledge the assistance and criticism given by several individuals in the preparation of this paper, particularly Prof. H. C. Hottel, chairman of the M.I.T. Committee on Solar Energy Conversion, and Profs. L. B. Anderson and A. L. Hesselschwerdt. The work reported in this paper is part of the continuing project in solar energy conversion established at the Massachusetts Institute of Technology by the gift of Godfrey L. Cabot.

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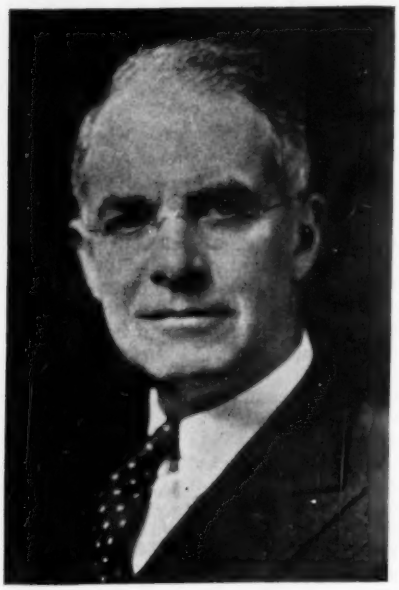


Alfred E. Stacey, Jr.
Syracuse, N. Y.
President

Proceedings 56th Annual Meeting Dallas

THE Society Officers elected for the year 1950, and inducted at the final session of the Annual Meeting in Dallas, were: President—Lester T. Avery, Cleveland; First Vice President—L. E. Seeley, Durham, N. H.; Second Vice President—Ernest Szekely, Milwaukee; Treasurer—Reg. F. Taylor, Houston.

Four new Council members were elected as follows: John E. Haines, Minneapolis; John W. James, Chicago; E. R. Queer, State College, Pa.; G. B. Supple, Indianapolis.

The attendance of 2157 members and guests exceeded the expectations of all except the Committee on Arrangements of North Texas Chapter, which, with true Texas optimism, had been certain that this would be the Society's largest meeting. The attendance was the second largest at any meeting held by the Society. The official registration figures were: members 935, guests 760, ladies 462.

Two hotels, the Baker and the Adolphus, were used as the meeting headquarters, and both hotels were used for technical sessions as well as other events. Five technical sessions were held.

Entertainment features included: a welcome luncheon at the Adolphus Hotel on January 23, at which Stanley Foran, was the speaker and P. N. Vinther was the toastmaster; a Chuck Wagon Dinner in the Foods Building at the State Fair Grounds, at 7:00 p.m. on January 23; a luncheon at the Adolphus Hotel on January 24, with K. C. Richmond, editor of *Coal-Heat*, as speaker on the subject, *The Human Equation—A Public Relations Problem in Heating and Air Conditioning;* the Annual Banquet in the ballroom at the Baker Hotel, at which C. Rollins Gardner, general chairman of the Committee on Arrangements, was the toastmaster, and Dr. Umphrey Lee, President of Southern Methodist University, was the principal speaker. Dr. Lee's subject was *The Fearful Era.*

Events of special significance at the Annual Banquet were the awarding of the F. Paul Anderson Medal of the Society to Dr. C.-E. A. Winslow, the presentation being made by Pres. Alfred E. Stacey, Jr.; the presentation of the Past-President's Emblem to Alfred E. Stacey, Jr., the presentation being made by Walter L. Fleisher, past-president of the Society; presentation of the Memory Book to past-president G. L. Tuve, which presentation was made by Mr. Fleisher.

The customary Past-President's Dinner was held on January 24th in the Adolphus Hotel, and was attended by Merrill F. Blankin, S. H. Downs, W. L. Fleisher, G. L. Tuve, and C.-E. A. Winslow.

Various Society committees were in session at all times during the entire meeting. Some of these committees were: Committee on Admission and Advancement, Chapter Delegates Committee, Committee on Code for Testing and Rating Heavy Duty Furnaces, Nominating Committee, Standards Committee, Committee on Research, and the Technical Advisory Committees on Panel Heating and Cooling, Air Distribution, Cooling Load, Insulation, Sensations of Comfort, Heat Pump, Sound Control, and Heat Flow Through Glass.

The *Southwest Air Conditioning Exposition* at the State Fair Grounds, was opened at 2:00 p.m. on January 23, by R. L. Thornton, president of the State Fair of Texas,

with participation in the ceremony by Pres. A. E. Stacey, Jr., Syracuse, N. Y., and other Society Officers.

FIRST SESSION, MONDAY, JANUARY 23RD, 9:30 A.M.

President Stacey called the meeting to order and introduced P. N. Vinther, chairman of the sessions committee, who welcomed the members and guests to the meeting, and spoke of the preparations made for entertainment of the visitors.

President Stacey acknowledged the cordial welcome which, he stated, had been evident to all from the minute of arrival in Dallas. The preparations made by the Committee on Arrangements, and the rapidly growing registration, together with the Exposition, made it easy to predict that this would be one of the most successful Society meetings.

Announcing that the next order of business was to receive reports of the Officers and Council, President Stacey gave the President's report.

Lester T. Avery
Cleveland, Ohio
President-Elect

Report of President

The year's activities of the Society are to be fully reported by the Chairmen of the several committees and so it seems to me to be totally unnecessary to anticipate these gentlemen. However, I wish to call your attention to a matter which is of outstanding importance. That is the rapid growth of the Society over the last 15 years. We have grown since 1935 from a membership of less than 2000 to our present gratifying membership of 7700. This is a gain of approximately 400 percent. Because of this extraordinary growth, our expenditures for the membership have increased at a correspondingly great rate, and the budget for 1950 is over $450,000. This is a large amount of money to be spent wisely and to the best interests of the Society. It is a heavy responsibility of your Council to see that this is done. From time to time, it has been necessary to meet the new situations resulting from this growth by Council action. Your Constitutions and By-Laws Committee have based the revision of the By-Laws, of which you have all received notice, upon these Council actions and those suggestions of committees which, of course, have met the approval of the Council.

One of a number of my pleasures and duties as President has been to visit many chapters of the Society. Nothing was left undone by these Chapters to make me welcome—I had the pleasure of making new friends and renewing old acquaintances. Best of all was the enthusiasm and great interest in the affairs of the Society which I found displayed throughout the country. I had not realized to what extent the Society had grown.

Every president of any organization feels that his acomplishments would be very feeble were it not for the cooperation and hard work of a very great many people. It is impossible for me to express my gratitude to the Council Members, Chairmen of Committees, Presidents of Chapters, the Staff Members of the Executive Office and the Laboratory, and a host of faithful members who have combined to bring about any success which this year has held. It has been a privilege to work with you all as your President.

Respectfully submitted,
ALFRED E. STACEY, JR.

Report of Council

The new Council held its first meeting in Chicago, Ill., January 27, 1949, with Pres. Alfred E. Stacey, Jr., presiding. He announced the personnel of the Council, General and Special Committees, the appointments of which were confirmed.

Appointment of the secretary, assistant to president, certified public accountant and legal counsel were made and the depositories for Society funds in New York, Cleveland, and Toronto were approved. New membership application and reference forms were approved and a procedure for expediting the election of student members was adopted.

A Special Committee on Membership Grades reported its recommendations which were referred to the Constitution and By-Laws Committee and a Special Committee on Clarification of Committee Functions outlining the scope of activities for the Chapter Relations Committee and the Chapter Delegates Committee. As required by the By-Laws, five candidates were nominated for a three-year term on the Committee on Research and four representatives and one alternate were selected for service on the Nominating Committee.

The time and place of the Semi-Annual Meeting, 1950, and the Annual Meeting, 1951, were announced respectively, at the Royal Muskoka Hotel, Ontario, June 19-21, with the Ontario Chapter as host and at Philadelphia,

Pa., January 22-25, with the Philadelphia Chapter as host. Approval was given to the Programs of the Minneapolis and Dallas Meetings as submitted by the Program and Papers Committee. An exhibit by the Society featuring its general activities and research work was approved for the Dallas exhibition. Council approved the plan of having expositions on a biennial basis after 1951.

A budget for the fiscal period November 1, 1949, to October 31, 1950, was adopted with estimated receipts of $427,790.00 and disbursements of $454,250.00. A Research Reserve Fund was created upon recommendation of the Finance Committee. Re-classification of the Society's status under the Internal Revenue Code is pending. The Council accepted with regret the resignation of Clyde A. McKeeman, as assistant to president, and the resignation of Prof. M. C. Giannini, as a member of the Committee on Research. P. B. Gordon was appointed to serve in Professor Giannini's place. A special meeting of the Society was held in New York, November 21, at which time the amended Charter was approved and it was voted to submit the new By-Laws to the Society for vote at the 56th Annual Meeting. The By-Laws were prepared by the Constitution and By-Laws Committee, submitted to Council in October, and a number of amendments by Council were incorporated in the final draft.

The award of the F. Paul Anderson Medal was approved and Dr. C.-E. A. Winslow was nominated for the award. Re-appointment of the Director of Research was voted.

Stanley Foran at Welcome Luncheon

Charters for two chapters and seven student branches were authorized.

During the year, Council voted on the admission of members recommended by the Admission and Advancement Committee and authorized Life Membership for eligible candidates. Action was taken on members who submitted resignations and cancellation of memberships for non-payment of dues was voted.

Respectfully submitted,
THE COUNCIL.

Report of the Secretary

The year 1949 has been one of exceptional activity at the headquarters office with many extra duties required in connection with the growth of membership, which is now at an all time high, the revision of the Charter and streamlining the By-Laws, more active committee work relating to chapters, Guide expansion, meetings, public relations and other administrative duties assigned by Council.

The financial statement reflects the expansion of Society activities, the membership report shows an increase in membership, THE GUIDE enjoyed a larger income but a small reduction in distribution.

The accounting system was completely overhauled and adapted to a machine bookkeeping set-up which became effective in November. New record cards for dues, address forms, a new type of duesbill were developed and installed. The result will cut down some of the operations, give quicker totals and provide better financial records.

Contact has been maintained with chapter officers and whenever practical visits have been made at regular meetings or with the officers. During the year the chapters responsible for the arrangements at the Semi-Annual and Annual Meetings at Minneapolis and Dallas respectively have worked closely with the Secretary's office and are to be commended for their work in planning and carrying out the great number of details required in making a successful meeting.

All of the Council Committees, Special Committees and General Committees have carried on their functions as required by the operating rules of the Society and it is a distinct pleasure to acknowledge their interest and cooperation.

My staff of associates at the headquarters office deserve an extra tribute for their loyal interest in the Society and their effective work, often under severe handicaps.

Respectfully submitted,
A. V. HUTCHINSON, SECRETARY

Dean Seeley, second vice president of the Society, gave a brief review of the status of Society finances, indicating that the Society was in excellent condition. He stated that the auditor's report would be published.

Committee on Arrangements making final plans for Annual Meeting in Dallas. ***(Seated—l. to r.)*** **G. A. Linskie, J. P. Ashcraft, R. E. Allison, R. J. Salinger, president of South Texas Chapter.** ***(Back row)*** **M. L. Brown, A. B. Carter, A. A. Stone, L. S. Gilbert, J. A. Ray, E. T. Gessell, P. N. Vinther, and C. Rollins Gardner**

Accountant's Report

Frank G. Tusa & Co.
Certified Public Accountants
37 Wall St.
New York 5, N.Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
51 Madison Ave.,
New York, N. Y.

Gentlemen:

Pursuant to your request, we examined the books of account and records of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York, N. Y. and the related funds for the fiscal year ended October 31, 1949 and submit herewith our report.

The audit covered a verification of the Assets and Liabilities as of the close of business October 31, 1949. Also for the fiscal year then ended, the recorded cash receipts were traced into the depositories; the cancelled bank checks were inspected and compared with the record of cash disbursements; the disbursements were supported by payment vouchers and the dues income from members and the interest income from investments was accounted for.

A balance sheet reflecting the financial condition of the Society as of the close of business October 31, 1949 is submitted herewith and your attention is directed to the following comments thereon:

CASH

The cash on deposit was verified by direct communication with commercial and savings banks and the balances reported to us were reconciled with those reflected by the books of the Society. A schedule of cash is included as a part of this report.

Checks representing the cash on hand for deposit were inspected by us and the petty cash was counted.

MARKETABLE SECURITIES

The securities shown on the subjoined schedule were verified by direct communication with the Bankers Trust Co., where same are deposited for safekeeping. This asset has been included in the balance sheet at the cost of acquisition plus the accumulated and accrued interest earned thereon.

ACCOUNTS RECEIVABLE

Trial balance taken of the membership dues receivable and sundry debtors as of the close of business October 31, 1949 were classified and aged as follows:

DUES RECEIVABLE

MEMBERSHIP	AMOUNT
Members	$ 4,100.92
Associates	8,967.84
Juniors	668.00
Students	143.00
TOTAL	$13,879.76

AGING

1949	$13,379.56
1948	438.20
1947	62.00
TOTAL	$13,879.76

SUNDRY DEBTORS

Unpaid charges made during October, 1949	$5,413.30
" " " " September, 1949	1,728.26
" " " " prior	1,197.93
TOTAL	$8,339.49

After writing off all receivables known to be uncollectible, it is our opinion that the reserves for dues and accounts receivable doubtful of collection reflected in the accompanying balance sheet are ample to cover collection losses that may be incurred.

INVENTORIES

The emblems and TRANSACTIONS on hand on October 31, 1949 were counted by us. THE GUIDE paper was verified by direct communication with the printers. All inventories were priced and computed by us.

A schedule of TRANSACTIONS inventoried follows:

Volume	Year	Quantity	Price	Amount
1-48	1895-1942	3295	$0.40	$1282.00
49	1943	231	1.39	321.09
50	1944	199	1.82	343.98
51	1945	348	1.91	664.68
52	1946	417	1.67	696.39
53	1947	327	1.77	578.79
	TOTALS	4717		$3886.93

DEPOSIT RECEIVABLE

The deposit placed with the United Air Lines in the sum of $425.00 was verified by direct communication.

ADVANCES

We have classified under exchanges advances made for the accommodation of Council members reimbursed subsequently to the date of audit.

As at October 31, 1949 the participating employees to the retirement plan were indebted in the sum of $1,433.46 for contributions advanced by the Society to the pension fund. This sum is to be reimbursed to the Society by periodical deductions from wages of employees covered by the plan.

DEFERRED CHARGES

One-sixth of all subscriptions paid during the current fiscal period to HPAC were deferred as a future expense since the subscriptions are paid on a calendar year basis and the fiscal year of the Society ended on October 31, 1949.

TAXES

The sum of $465.10 represents federal income taxes withheld from salaries paid to employees during the month of October, 1949. The Society may be subject to possible social security tax assessments pending decision from the U.S. Treasury Department.

DUE RESEARCH

The balance due the Research Laboratory as at October 31, 1949 is made up as follows:

40 Percent of Dues Receivable from Members and Associates		$5,227.50
Less: 40 Percent of Dues Prepaid by Members and Associates	$419.91	
Amount advanced to George Hastings for fund raising expenses on behalf of Research	40.54	460.45
BALANCE		$4,767.05

ACCRUED ACCOUNTS

The salaries and commissions accrued as at October 31, 1949 have been computed by us in accordance with the Finance Committee report of April 8, 1948. Other accruals cover various expenses applicable to the current fiscal year.

DEFERRED INCOME

The prepaid dues and initiation fees by members and candidates for membership have been deferred to future operations. The membership classification of the dues prepaid by elected members follow:

MEMBERSHIP	AMOUNT
Members	$ 505.18
Associates	544.59
Juniors	344.67
Students	62.00
TOTAL	$1,456.44

RESERVE FOR TRANSACTIONS

We have reserved the sum of $24,500.00 to cover the publication of TRANSACTIONS Volumes 54 and 55 that are scheduled for publication in 1950.

FUNDS

An analysis of the following fund accounts covering the changes that occurred therein during the fiscal year ended October 31, 1949 is attached hereto:

General Fund
Reserve Fund
F. Paul Anderson Fund
Property Fund
Mortgage Reduction Fund

In accordance with the resolution adopted by the council at its meeting of January 23, 1949 depreciation was not provided on the buildings for the current fiscal year.

Respectfully submitted,

FRANK G. TUSA & CO.
Certified Public Accountants

JOURNAL SECTION

BALANCE SHEET

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York
October 31, 1949

ASSETS

GENERAL FUND			
CASH			
On Deposit		$52,927.51	
On Hand		100.00	$53,027.51
SECURITIES (At Cost)			
Securities (Market Value $47,005.59)		43,610.75	
Add: Accumulated Interest	$ 4,149.84		
Accrued Interest	182.90	4,332.74	47,943.49
ACCOUNTS RECEIVABLE			
Membership Dues	13,879.76		
Less: Reserve for Doubtful	6,000.00	7,879.76	
Advertisers and Sundry Debtors	8,339.49		
Less: Reserve for Doubtful	1,000.00	7,339.49	15,219.25
INVENTORIES			
Transactions		3,886.93	
Emblems		448.75	
Guide Paper		335.00	4,670.68
DEPOSITS RECEIVABLE			425.00
EXCHANGES			1,359.16
ADVANCES TO PENSION FUND FOR EMPLOYEES			1,433.46
DEFERRED CHARGES			
Prepaid HPAC Subscriptions		2,432.46	
Prepaid Advertising Sales Promotion		900.00	
Unexpired Insurance Premiums		248.70	3,581.16 $127,659.71
PROPERTY FUND			
Land and Buildings		84,920.96	
Less: Reserve for Depreciation		3,908.07	81,012.89
Furniture and Fixtures		7,389.17	
Less: Reserve for Depreciation		1,556.17	5,833.00
Library			300.00 87,145.89
RESERVE FUND			
Cash on Deposit			3,563.80
Securities at Cost (Market Value $46,436.20)		40,145.00	
Add: Accumulated Interest		6,291.20	46,436.20 50,000.00
F. PAUL ANDERSON FUND			
Cash on Deposit		86.08	
Cash on Hand for Deposit		25.00	111.08
Securities at Cost (Market Value $947.00)		1,000.00	
Add: Accrued Interest		12.50	1,012.50 1,123.58
			$265,929.18

LIABILITIES AND FUNDS

LIABILITIES			
FEDERAL WITHHOLDING TAX			$ 465.10
DUE RESEARCH			4,767.05
ACCRUED ACCOUNTS			
Salaries and Commissions		$ 7,895.10	
Expenses		4,313.37	12,208.47
DEFERRED INCOME			
Prepaid Membership Dues:			
Elected Members	$1,456.44		
Candidates	1,092.75	2,549.19	
Prepaid Initiation Fees		1,679.00	
Past President's Award		100.00	4,328.19
RESERVE FOR TRANSACTIONS			
Transactions—Volume 53		1,651.85	
Transactions—Volume 54		12,000.00	
Transactions—Volume 55		12,500.00	26,151.85
TOTAL LIABILITIES			$47,920.66
FUNDS			
Property Fund			87,145.89
Reserve Fund			50,000.00
F. Paul Anderson Fund			1,123.58
General Fund			79,739.05
NET WORTH OF SOCIETY			218,008.52
$265,929.18			

NOTE: This balance sheet is subject to possible assessments for social security taxes pending decision by the Treasury Department.

CONDENSED COMPARATIVE CONSOLIDATED BALANCE SHEET

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York
October 31, 1949

	October 31, 1949	October 31, 1948	Increases Decreases
ASSETS			
Cash on Hand and on Deposit	$124,703.13	$ 88,878.18	$35,824.95
Securities (At cost)	95,392.19	83,683.64	11,708.55
Accounts Receivable (Less: Reserve for Doubtful)	21,396.43	15,591.09	5,805.34
Inventory of Paper, Emblems, etc.	4,670.68	5,213.26	(542.58)
Deposits Receivable	437.00	425.00	12.00
Accommodations	2,784.23	2,750.99	33.24
Land and Buildings (Less: Reserve for Depreciation)	81,012.89	81,012.89	-0-
Laboratory Equipment, Tools, Furniture, Fixtures and Library (Less: Reserve for Depreciation)	26,984.43	23,002.52	3,981.91
Deferred Charges	5,087.30	2,595.65	2,491.65
TOTAL ASSETS	$362,468.28	$303,153.22	$59,315.06
LIABILITIES			
Accounts Payable	$ 118.75	$ -0-	$ 118.75
Federal Withholding Taxes	465.60	524.20	(58.60)
Accrued Acounts	12,208.47	7,998.26	4,210.21
Deferred Incomes:			
Research Projects	18,398.14	25,722.89	(7,324.75)
Prepaid Dues, Initiation Fees, etc.	4,328.19	3,595.54	732.65
Real Estate Mortgage Payable	-0-	7,000.00	(7,000.00)
Reserve for Publication of Transactions	26,151.85	24,000.00	2,151.85
TOTAL LIABILITIES	$ 61,671.00	$ 68,840.89	$(7,169.89)
FUNDS			
Property Funds	$107,997.32	$ 97,015.41	$10,981.91
Reserve Funds	80,718.10	54,000.00	26,718.10
F. Paul Anderson Fund	1,123.58	1,097.50	26.08
Mortgage Reduction Fund	-0-	162.78	(162.78)
Research Endowment Fund	659.17	649.41	9.76
Research Fund	30,560.06	20,622.53	9,937.53
General Fund	79,739.05	60,764.70	18,974.35
Net Worth	300,797.28	234,312.33	66,484.95
TOTAL LIABILITIES AND FUNDS	$362,468.28	$303,153.22	$59,315.06

COMPARATIVE CASH BUDGET SUMMARY

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York
For the Fiscal Year Ended October 31, 1949

RECEIPTS	Actual	Budget Provision	Increases	Decreases
Dues and Initiation Fees	$ 93,402.87	$ 95,785.00	$	$ 2,382.13
Publications	146,565.64	131,700.00	14,865.64	
Interest	853.46	500.00	353.46	
Other	3,732.35	2,000.00	3,732.35	
Research	166,741.10	207,925.00		41,183.90
TOTAL RECEIPTS	$413,295.42	$437,910.00	$18,951.45	$ 43,566.03
DISBURSEMENTS				
Committee and Chapters	$ 14,092.06	$ 26,400.00		$ 12,307.94
Meetings	4,136.50	6,500.00		2,363.50
Publications	101,202.38	110,500.00		9,297.62
Headquarters	93,291.54	101,175.00		7,883.46
Research	146,023.88	222,500.00		76,476.12
TOTAL DISBURSEMENTS	$358,746.36	$467,075.00		$108,328.64
DIFFERENCE	$ 54,549.06	$(29,165.00)		

BUDGET COMPARISON—CASH RECEIPTS

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York
For the Fiscal Year Ended October 31, 1949

DUES CURRENT MEMBERS	Actual	Budget Provision	Increases	Decreases
6A—Members	$ 38,308.99	$ 39,000.00	$	$ 691.01
6B—Asociates	34,743.13	36,000.00		1,256.87
6C—Juniors	4,695.06	5,000.00		304.94
6D—Students	961.00	900.00	61.00	
	78,708.18	80,900.00	61.00	2,252.82
NEW MEMBERS				
104—Members	1,223.30	1,875.00		651.70
105—Associates	2,249.85	1,500.00	749.85	
106—Juniors	1,920.00	500.00	1,420.00	
107—Students	1,148.00	150.00	998.00	
	6,541.15	4,025.00	3,167.85	651.70

PRIOR YEARS DUES				
6E—Members	1,024.00	1,200.00		176.00
6F—Associates	1,443.04	1,500.00		56.96
6G—Juniors	182.50	400.00		217.50
6H—Students	18.00	60.00		42.00
	2,667.54	3,160.00		492.46
TOTAL DUES	87,916.87	88,085.00	3,228.85	3,396.98
106—INITIATION FEES	5,486.00	5,500.00		14.00
DEFERRED INCOME				
Prepaid Membership Dues	1,456.44	1,000.00	456.44	
Prepaid Dues by Candidates	1,092.75	200.00	892.75	
108A—Prepaid Initiation Fees	1,679.00	1,000.00	679.00	
	4,228.19	2,200.00	2,028.19	
PUBLICATIONS				
115—Journal Contract	24,333.32	23,500.00	833.32	
300—Guide Advertising	60,241.01	56,000.00	4,241.01	
302—Guide	59,024.99	50,000.00	9,024.99	
117—Transactions	861.93	1,500.00		638.07
118—Books, Reprints and Codes	2,104.39	700.00	1,404.39	
	146,565.64	131,700.00	15,503.71	638.07
INVESTMENT INCOME				
125—Interest—Savings Bank	332.45	100.00	232.45	
126—Interest—Securities	521.01	400.00	121.01	
	853.46	500.00	353.46	
OTHER INCOME				
109—Sale of Emblems	978.16	1,500.00		521.84
110—Sale of Certificate Frames	526.00	500.00	26.00	
	1,504.16	2,000.00	26.00	521.84
RESEARCH LABORATORY RECEIPTS				
40 Percent of Members and Associates Dues	53,718.75	54,050.00		331.25
Contributions—Allocated	56,477.50	60,000.00		3,522.50
Contributions—General	8,635.00	10,000.00		1,365.00
Navy Research	21,042.49	59,375.00		38,332.51
Exposition—1949	26,718.10	24,500.00	2,218.10	
Exposition—1948	50.00	-0-	50.00	
Interest	6.76	-0-	6.76	
Bulletins	92.50	-0-	92.50	
	166,741.10	207,925.00	2,367.36	43,551.26
TOTAL RECEIPTS	$413,295.42	$437,910.00	$23,507.57	$48,122.15

BUDGET COMPARISON—CASH DISBURSEMENTS

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—New York

October 31, 1949

COMMITTEES AND CHAPTERS	Actual	Budget Provision	Increases	Decreases
150—President's Fund	$ 952.40	$ 3,000.00	$	$ 2,047.60
151—Council Travel	2,680.80	7,200.00		4,519.20
160—Executive Committee	122.14	100.00	22.14	
161—Finance Committee	95.99	100.00		4.01
162—Membership Committee		1,000.00		1,000.00
164—Standards Committee		150.00		150.00
170—Admissions and Advancement Committee	635.55	1,000.00		364.45
171—Constitution and By-Laws	143.37	1,000.00		856.63
172—Nominating Committee	1,292.54	1,500.00		207.46
173C—Chapter Relations Committee	511.55	500.00	11.55	
173A—Chapter Speakers	1,584.54	3,000.00		1,415.46
173B—Chapter Delegates	3,227.97	5,000.00		1,772.03
201—A.S.A. Membership	100.00	100.00		
204—Membership Certificates	1,654.16	750.00	904.16	
204A—Framed Certificates	335.00	250.00	85.00	
205—Emblems	684.65	1,500.00		815.35
206—Medals and Awards	71.40	250.00		178.60
	14,092.06	26,400.00	1,022.85	13,330.79

MEETINGS				
163—Meetings	3,536.50	4,500.00		963.50
327—Chapter Meeting Allowance	600.00	2,000.00		1,400.00
	4,136.50	6,500.00	-0-	2,363.50
PUBLICATIONS				
200—Journal Subscriptions	14,808.99	14,000.00	808.99	
202—Transactions—Volume 53	10,490.37	12,000.00		1,509.63
Transactions—Volume 54		12,000.00		12,000.00
203—Membership Roll	5,376.07	2,500.00	2,876.07	
305—326—Guide Publication and Distribution	68,782.97	70,000.00		1,217.03
118A—Books, Reprints, Codes	1,743.98		1,743.98	
	101,202.38	110,500.00	5,429.04	14,726.66
HEADQUARTERS				
210—Salaries	59,282.86	64,000.00		4,717.14
210A—Contingent Fund		2,000.00		2,000.00
211—Public Relations Expense	4,544.40	5,000.00		455.60
212—Travel—Secretary and Staff	3,123.15	3,000.00	123.15	
213—Rent and Light	5,329.56	5,600.00		270.44
214—Telephone	1,548.06	1,200.00	348.06	
215—Telegraph	399.94	500.00		100.06
216—Postage	4,446.52	4,000.00	446.52	
217—Printing and Stationery	3,451.18	3,500.00		48.82
219—Addressing and Address Changes	365.47	300.00	65.47	
220—Professional Services	3,410.47	3,500.00		89.53
221—Bank Charges	57.76	75.00		17.24
222—Insurance	457.57	1,000.00		542.43
11—Furniture and Fixtures	4,233.95	4,500.00		266.05
223—General Office Expenses	1,205.89	1,500.00		294.11
224—Pension	1,434.76	1,500.00		65.24
	93,291.54	101,175.00	983.20	8,866.66
RESEARCH				
Research Committee Expenses	1,926.25	3,000.00		1,073.75
Staff Salaries	77,699.77	95,400.00		17,700.23
Laboratory Expenses	24,209.42	45,000.00		20,790.58
Laboratory Operations and Maintenance	11,319.54	12,000.00		680.46
Cooperative Research	14,041.00	20,600.00		6,559.00
Navy Research	16,827.90	46,500.00		29,672.10
	146,023.88	222,500.00	-0-	76,476.12
TOTAL DISBURSEMENTS	$358,746.36	$467,075.00	$7,435.09	$115,763.73

UNBUDGETED DISBURSEMENTS	
Investments	$ 9,171.25
Final Mortgage Payment	7,000.00
Loss on Canadian Exchange	1,537.71
Accounts Receivable and Exchanges	959.89
Federal Withholding Taxes	61.50
Hospitalization Advances—Research	82.60
	$18,812.95

BALANCE SHEET

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—RESEARCH FUND—New York, N. Y.

October 31, 1949

ASSETS

RESEARCH FUND			
CASH			
ON DEPOSIT			
Treasurer's Account—Bankers Trust Co.	$16,231.70		
Director's Account—Cleveland Trust Co.	5,237.03		
Travel Account—Cleveland Trust Co.	500.00		
Thrift Account—Bank for Savings	458.27	$22,427.00	
IN TRANSIT		2,946.31	
ON HAND FOR DEPOSIT		11,000.16	
ON HAND		250.00	$ 36,623.47

JOURNAL SECTION

ACCOUNTS RECEIVABLE			
ASHVE (40 Percent of Dues when Collected)		4,767.05	
U.S. Navy Department		5,112.01	
Advances to Employees:			
Retirement Plan	976.97		
Hospitalization	88.20	1,065.17	10,944.23
DEPOSIT RECEIVABLE			
Drums			12.00
PERMANENT			
Laboratory Equipment, Furniture and Fixtures	34,988.06		
Less: Reserve for Depreciation	14,436.63	20,551.43	
Tools		300.00	20,851.43
DEFERRED CHARGES			
Unexpired Insurance Premiums			1,506.14
TOTAL RESEARCH FUND			69,937.27
RESERVE FUND			
CASH ON DEPOSIT			
Bankers Trust Co.		4,000.00	
Central Bank for Savings		5,300.00	
Dime Savings Bank		5,518.10	
East River Savings Bank		5,300.00	
Emigrant Industrial Savings Bank		5,300.00	
Seaman's Bank for Savings		5,300.00	
TOTAL RESERVE FUND			30,718.10
ENDOWMENT FUND			
CASH ON DEPOSIT			
Bank for Savings			659.17
			$101,314.54

LIABILITIES AND FUNDS

LIABILITIES			
ACCOUNTS PAYABLE		$ 118.75	
FEDERAL WITHHOLDING TAX		.50	
DEFERRED INCOME			
Sound Energy Studies	$ 574.39		
Heat Losses Due to Infiltration	188.75		
Panel Heating Studies	8,585.00		
Odor Studies	3,550.00		
Heat Flow Through Glass	5,000.00		
Miscellaneous	500.00	18,398.14	
EXCHANGES		8.39	$ 18,525.78
FUNDS			
Property Fund		20,851.43	
Reserve Fund		30,718.10	
Endowment Fund		659.17	
Research Fund		30,560.00	82,788.76
			$101,314.54

NOTE "A"—This balance sheet may be subject to possible assessments for Social Security taxes pending final decision by the Treasury Department.

BUDGET COMPARISON—CASH RECEIPTS AND DISBURSEMENTS

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—RESEARCH FUND—New York, N.Y.
For the Fiscal Year Ended October 31, 1949

CASH RECEIPTS	Actual	Budget Provision	Increases	Decreases
40 Percent Dues—Members and Associates	$ 53,718.75	$ 54,050.00	$	$ 331.25
Heating and Ventilating Exposition—1949	26,718.10	24,500.00	2,218.10	
Heating and Ventilating Exposition—1948	50.00		50.00	
Allocated Contributions—1949	56,477.50	60,000.00		3,522.50
General Contributions	8,635.00	10,000.00		1,365.00
Office of Naval Research	21,042.49	59,375.00		38,332.51
Interest	6.76		6.76	
Sale of Bulletins	92.50		92.50	
TOTALS	$166,741.10	$207,925.00	$2,367.36	$43,551.26

ALLOCATED CONTRIBUTIONS—1949				
Heat Transfer Through Glass	$ 15,330.00	$ 22,000.00	$	$ 6,670.00
Heat Transfer—General	450.00		450.00	
Physiological Studies	4,171.00	6,000.00		1,829.00
Air Cleaning	6,250.00	6,000.00	250.00	
Air Flow—General	3,700.00	2,000.00	1,700.00	
Panel Heating and Cooling	18,526.50	20,000.00		1,473.50
Odors	3,550.00		3,550.00	
Miscellaneous	4,500.00	4,000.00	500.00	
TOTALS	$ 56,477.50	$ 60,000.00	$6,450.00	$ 9,972.50

CASH DISBURSEMENTS COMMITTEE EXPENSES				
100—Travel and Meeting Expenses, Chairman, Research Executive Committee and Technical Advisory Committees	$ 1,598.25	$ 2,500.00		901.75
101—Chairman's Office Expense	328.00	500.00		172.00
	1,926.25	3,000.00	-0-	1,073.75
LABORATORY SALARIES				
150—Administrative and Technical Staff	65,145.46	75,600.00		10,454.54
151—Clerical Staff	10,994.59	10,800.00	194.59	
152—Pension Contributions	933.46	1,500.00		566.54
153—Part Time Staff and Contingencies	626.26	7,500.00		6,873.74
	77,699.77	95,400.00	194.59	17,894.82
LABORATORY EXPENSES				
160—Staff Travel	4,523.17	4,800.00		276.83
161—Postage	500.54	1,000.00		499.46
162—Telephone and Telegraph	1,714.82	1,800.00		85.18
163—Office Supplies	1,234.66	1,200.00	34.66	
164—Mimeographing and Printing	1,685.11	1,500.00	185.11	
165—Library	538.52	300.00	238.52	
166—Publication Expenses (Bulletins)	2,013.33	4,000.00		1,986.67
167—Staff Insurance	186.46	400.00		213.54
168—Professional Services	368.73	500.00		131.27
169—Unallocated	690.47	2,000.00		1,309.53
170—Contingencies		2,500.00		2,500.00
171—Education and Information	3,661.66	5,000.00		1,338.34
250—Laboratory Materials and Supplies	3,497.67	10,000.00		6,502.33
300—Permanent Equipment	3,594.28	10,000.00		6,405.72
	24,209.42	45,000.00	458.29	21,248.87
LABORATORY OPERATION AND MAINTENANCE				
200—Mortgage Interest	78.75	200.00		121.25
202—Heat	1,031.36	1,200.00		168.64
203—Utilities	1,388.00	1,500.00		112.00
204—Janitor Wages	2,223.53	2,500.00		276.47
205—Janitor Supplies	148.12	300.00		151.88
206—Building Maintenance	1,341.15	1,500.00		158.85
207—Building Alterations	2,808.13	2,000.00	808.13	
208—Insurance	1,564.50	2,000.00		435.50
210—Contingencies	736.00	800.00		64.00
	11,319.54	12,000.00	808.13	1,488.59
COOPERATIVE RESEARCH				
1000—Pledged to June 30, 1949	6,541.00	6,800.00		259.00
1100—Pledged to October 31, 1949	7,500.00	13,800.00		6,300.00
	14,041.00	20,600.00	-0-	6,559.00
NAVY COMMITTEE EXPENSE				
N100—Travel and Meeting	403.95	2,000.00		1,596.05
STAFF SALARIES				
N150—Engineering and Tech. Staff	8,647.99	10,500.00		1,852.01
N151—Clerical Staff		1,000.00		1,000.00
N153—Part Time Staff and Contingencies		1,000.00		1,000.00
LABORATORY EXPENSES				
N160—Laboratory Expense—Staff	513.72	2,000.00		1,486.28
N250—Laboratory Materials Laboratory Supplies	4,369.85	10,000.00		5,630.15
	2,892.39	20,000.00		17,107.61
	16,827.90	46,500.00	-0-	29,672.10
TOTALS	$146,023.88	$222,500.00	$1,461.01	$77,937.13
UNBUDGETED DISBURSEMENT				
Advances to Employees Hospitalization	$82.60			

Referring to the proposed new By-Laws of the Society, President Stacey stated that since they had been submitted to the membership in accordance with the laws of New York State, that the ballot box would be open for those who had not appointed proxies until 5:00 p.m. He also stated that those who had appointed proxies and wished to recall or change such proxies, were free to make such changes by applying to M. F. Blankin, Philadelphia, until the ballot box was closed.

President Stacey appointed a Board of Tellers consisting of Herman Worsham, Dayton, Ohio, chairman, Paul D. Close, Seattle, Wash., and Ira W. Wilke, Austin, Tex., and instructed the Tellers to report the result of the election at the next session.

The first technical paper, **Night-Air Cooling** by F. E. Giesecke, (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1950) was presented by Dean J. S. Hopper of Arlington State College, Arlington, Tex. Dean Hopper expressed the regrets of Dr. Giesecke, who had been prevented from attending the meeting by the illness of his wife.

Lester T. Avery, Cleveland, remarked that night cooling was possible also in localities where the atmosphere contained dust, because means were available for cleaning the air. He stated also that moisture and dampness were greater obstacles than dust.

P. R. Achenbach, Washington, D. C., pointed out that gravity means of circulating night air could be employed, and gave as an example the practice in certain western states where indoor temperatures could be maintained 20 deg below outdoor temperatures by admitting air at night and keeping the shades drawn and windows closed during the day, even where outdoor temperatures reached 110 F.

Dean Hopper presented the author's closure by agreeing with Mr. Achenbach that inside temperatures could be reduced considerably by night-air cooling, and keeping windows and shades drawn during the day.

P. N. Vinther outlined the special events which had been planned, and emphasized particularly the Get-Together Luncheon which was to follow the session, the Chuck Wagon Dinner planned for the evening, and five inspection trips which had been arranged.

The next technical paper was **Physiologic Examination of the Effective Temperature Index**, by Nathaniel Glickman, Tohru Inouye, R. W. Keeton and M. K. Fahnestock, which was presented by Professor Glickman (paper published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January, 1950).

Written discussions received from Dr. Craig L. Taylor, Los Angeles, Dr. Thomas Bedford, London, England, Dr. W. J. McConnell, New York, Dr. C.-E. A. Winslow, New Haven, Conn., C. S. Leopold, Philadelphia, C. M. Ashley, Syracuse, N. Y., and First Vice President Avery, together with the author's closure, will be published with the paper in complete form in the Society TRANSACTIONS.

Dr. Taylor's discussion pointed out that various imperfections in the effective temperature scale had come to light, the most common of which was that in the approximate

Welcome to Texas—Bang! Bang! Bang!

K. C. Richmond addresses Public Relations Luncheon

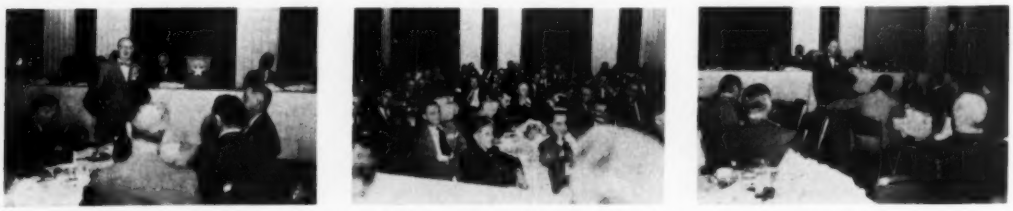
range of 60 to 80 ET, the negative slope of the ET lines on a temperature humidity plot was too great. He agreed that a redefinition of thermal comfort and discomfort was timely, and that incorporation of the concept of physiological balance or imbalance, as the basic factor determining the intensity of thermal sensation and feeling, was worth the emphasis placed upon it by the authors. He also suggested that further investigations along the humidity line were advisable because the ET curves might not be straight lines between the low and high limits of humidity.

Dr. Bedford's discussion pointed out that on the basis of over 2500 observations made 14 years ago, he had found subjective feelings of warmth were predicted with greater accuracy from a knowledge of the warmth of the environment than from measurement of the skin temperature on the forehead, hand and foot. He also felt that the test results reported indicated that the dry bulb temperature was distinctly better than effective temperature as an index of warmth, especially when considering a group of people. Another comment of Dr. Bedford was that the feeling of comfort could be determined better by asking the individual regarding his feelings than by measuring his skin temperature.

Dr. McConnell's discussion called attention to the fact that the present ET index was not wholly developed from instantaneous thermal impressions of subjects passing back and forth between conditioned rooms. He mentioned that three groups of tests were: first, 12 experienced subjects remained in the test chamber for a period of three hours in the morning, and for two and one-half hours in the afternoon, and second, 14 subjects participated in a series of two-hour tests, and third, 100 individuals participated in a series of short tests of 15 min or longer. Other tests mentioned pertained to physiologic studies of the effects of high temperature and varying humidities in tests conducted over a period of years. The difficulty of using a single index indicating degree of comfort perceived by an individual under various environments was caused by the complexity of physical and physiological factors affecting thermal comfort.

Dr. Winslow pointed out that he and Dr. L. P. Herrington had found that while the ET scale provided a satisfactory index of equivalent conditions at dry bulb temperatures above 81 F, and likewise served to equate the equivalent sensation effects of humidity and temperature for situations in which persons passed from a moderate dry bulb atmosphere to a similar temperature at high or low humidity, it was found that after adaptation over a period of one to two hours, the sensations realized were not in accord with the ET scale. It was therefore concluded that in the moderate temperature range 68 to 81, the effect of humidity is overemphasized by the ET index. It had therefore been urged that in this area mean skin temperature was a true physiological index of comfort. Dr. Winslow recommended that sufficient studies should be conducted to make it possible to obtain a fundamental revision of the effective temperature chart.

Mr. Leopold stated that according to the original ET data for summer conditions, a change from 35 to 60 percent relative humidity represented approximately a three-degree change in dry bulb temperature. While practically all investigators agreed regarding the general effect of relative humidity, they disagreed slightly as to whether the effect should be one and one-half or three degrees in the range of 35 to 60 percent relative humidity at 71 ET in summer. While the author had stated that the original data upon which the ET was established was obtained from instantaneous



G. A. Hastings and T. H. Urdahl discuss the public relations problem at Luncheon Meeting

thermal impressions, he felt that as early as 1923 the Research Laboratory had substantially verified the data for conditions of longer exposure. The general effect of relative humidity as obtained by the authors in this, as well as preceding papers, has been ably confirmed by the authors.

In appraising the results of this paper for application to everyday practice, Mr. Leopold felt that consideration should be given to two items, first, the union suit used in this experiment had not been demonstrated to be equal to multi-layer clothing in regard to radiation, convection and moisture retention; second, all subjects in this experiment wore the same type of union suit, whereas in ordinary living there is a wide diversity in clothing. Mr. Leopold believed that possibly Professor Glickman would obtain a new effective temperature line for individuals identically clothed that would have little relation to the line for an ordinary group of persons not similarly clothed. Mr. Leopold agreed that there was need for a new definition for comfort, and referred to a definition he had given previously as *the absence of discomfort or of annoyances due to temperature and atmospheric effects indoors.*

The general approach to comfort, rather than a determination by means of stimulus, was preferred because the former would tend to establish more normally the conditions which a group would like to have for a comfortable environment.

In the discussion by Mr. Ashley, which was read by W. A. Grant, it was stated that the data reported indicated that there are two distinct temperature zones, the lower in which the dry bulb temperature is the predominant factor, and the upper, above the sweat line, where the effective temperature is the predominant factor.

By plotting mean skin temperature, thermal sensation index and body moisture loss against dry bulb temperature, the data being taken from Table 2, it was found that the values of mean skin temperature at 80 and 30 percent RH, correlated well on a dry bulb temperature basis. It was also found that the thermal sensation index correlated well on a dry bulb temperature basis up to the highest temperature reading at 80 percent RH, and up to the three highest temperature readings at 30 percent RH. The correlation between the thermal sensation index and effective temperature, however, was very poor, except at the top effective temperature.

By plotting curves of dry bulb temperature against latent heat per person, it was found that the latent heat per person at the lower temperature range is nearly constant, and that there is a relatively small difference between the rate at 80 percent and 30 percent RH. This tends to substantiate the observation that relative humidity has very little effect, and that temperature is the predominant factor in controlling thermal sensation.

For the lower temperature ranges reported in the paper, it could be concluded that the ET lines should be almost vertical, and should show an increasing slope as the temperature increases above the point where perspiration begins. This effect on the ET lines seems reasonable since it would be expected that where the skin was dry and little evaporation occurred, humidity would have a correspondingly small effect, whereas humidity would become important when the temperature range was reached where bodily temperature control was effected through evaporation from the body surface.

Attention was also called to the fact that different experimental subjects were used for different sets of tests. A study of individual records for the purpose of attempting adjustments to compensate for individual differences in subjects was therefore suggested.

It was recommended that further detailed exploration be conducted in the region near and above the perspiration point, as such tests might indicate a need for substantial modification of the ASHVE Comfort Chart.

First Vice President Lester T. Avery referred to the progress made over a long period of time in the study of man and his relationship to the air environment. He also mentioned the progress which the Society had made in this study.

It was suggested that there might be difficulty in exactly establishing ET lines, and that possibly effective temperature zones might be substituted. He cited the findings of various investigators who had reported that, in the general range of 20 to 60 percent RH and 69 to 71 ET, it was difficult to establish the exact positions of ET lines. It was therefore suggested that several effective temperature zones might be used, one being that in which conditions were most favorable or where there is a minimum strain caused by adjustment of the individual. Two zones, one above and one below the optimum might be called the zones in which the subject would be slightly too warm and slightly too cool. Outside of these zones would be broad zones which might be called cold and hot. Other zones might be the zone of freezing and below freezing on one side, and the zone of fever heat on the other.

As a result of the continued study of effective temperature at the ASHVE Research Laboratory, and the work of the Technical Advisory Committee on Sensations of Comfort, it was anticipated that a general range of temperatures and humidities for design purpose might be established to the satisfaction of the physiologist, the medical practitioner and the engineer.

Walter L. Fleisher, New York, N. Y,. gave a short review of the work of the Society in establishing the ET lines and zones, and developing the comfort chart, and commented upon the effect of relative humidity. Mr. Fleisher's remarks will be published with the paper in the TRANSACTIONS.

President Stacey made a special announcement regarding the opening of the *Southwest Air Conditioning Exposition*, and advised the members to assemble promptly at the welcome luncheon which was to follow the technical session, whereupon the meeting was adjourned.

SECOND SESSION, TUESDAY, JANUARY 24TH, 9:30 A.M.

The second session was called to order by First Vice President Avery, who asked Mr. Worsham, chairman of the Board of Tellers, to report the results of the election, and the vote on the adoption of the proposed new By-Laws of the Society. The report follows:

Report of Tellers of Election

Ballot for Officers	Total
President, Lester T. Avery, Cleveland, Ohio	1141
1st Vice Pres., L. E. Seeley, Durham, N. H.	1141
2nd Vice Pres., Ernest Szekely, Milwaukee, Wis.	1141
Treasurer, Reg F. Taylor, Houston, Tex.	1132

Members of Council

(Three-Year Term)

J. E. Haines, Minneapolis, Minn.	1083
J. W. James, Chicago, Ill.	1081
E. R. Queer, State College, Pa.	1070
G. B. Supple, Indianapolis, Ind.	1069
Total Ballots Received	1206
Total Legal Ballots	1143
Invalid Ballots	63
Scattering votes:	
President	2
1st Vice Pres.	1
2nd Vice Pres.	2
Council	8
Comm. on Res.	15

Committee on Research

(Three-Year Term)

C. F. Boester, Lafayette, Ind.	1063
R. C. Cross, Chicago, Ill.	1075
R. S. Dill, Washington, D. C.	1062
A. J. Hess, Los Angeles, Calif.	1064
H. A. Lockhart, Morton Grove, Ill.	1078

(One-Year Term)

P. B. Gordon, New York	1084

Adoption of Society By-Laws

For	1084
Against	50

Respectfully Submitted

Ira W. Wilke
Paul D. Close
Herman Worsham, *Chairman*

The first technical paper, **Thermodynamic Criteria for Heat Pump Performance,** by John F. Sandfort, was presented by the author (paper published in ASHVE Journal Section, *Heating, Piping & Air Conditioning,* September, 1949).

Verbal comments made from the floor will be included with the paper when published in the ASHVE Transactions.

F. R. Ellenberger presented the paper, **Evaluating Heat Pump Performance,** by F. R. Ellenberger, A. B. Hubbard, W. R. Foote, F. Burggraf and J. J. Martin, Jr. (paper published in ASHVE Journal Section, *Heating, Piping & Air Conditioning,* January 1950).

P. R. Achenbach, Washington, D. C., remarked that the authors had reversed the usual process of selecting equipment of proper capacity for a house because the heat pump had first been selected, and then houses of the size, type and climatic zones suited to the unit, were selected.

The desirability of further discussion of the use of city water as an auxiliary heat source, was suggested. More information about the percentage of degree days at which auxiliary heat would be required, and further consideration of the effect of the compressor capacity, should be given.

It was pointed out that no mention was made of the extra capacity required for pickup of temperature in a house following a night setback of temperature. The item of electric demand charged during the pickup period might cause an increase in electrical power cost in certain cases because the maximum heating demand within the house might coincide with the time of maximum pickup load.

The question was also raised whether the readings of instruments as recorded by photographs taken immediately after the compressor had stopped in any cycle, would indicate the average pressures obtained during the cycle of operation.

A discussion from the floor by C. S. Leopold, and the author's closure, will appear with the paper in the ASHVE Transactions.

The next technical paper was, **Condensation on Prefabricated Walls,** by E. R. Queer and E. R. McLaughlin, which was presented by Professor Queer (published in ASHVE Journal Section, *Heating, Piping & Air Conditioning,* December 1949).

Comments from the floor were presented by F. E. Ince, St. Louis; W. A. Danielson, Memphis; Art Theobald, El Paso, Tex.; and Warren Viessman, Port Hueneme, Calif. These discussions, together with the author's closure, will appear with the paper when published in the ASHVE Transactions.

With the announcement that a luncheon meeting would be held in the Adolphus Hotel at 12:30, with M. F. Blankin presiding, the meeting was adjourned.

THIRD SESSION, WEDNESDAY, JANUARY 25TH, 9:30 A.M.

Second Vice President L. E. Seeley was the presiding officer at the third session. He called upon Prof. A. G. H. Dietz to present the paper, **Solar Heating of Houses by Vertical South Wall Storage Panels,** by Albert G. H. Dietz and Edmund L. Czapek. (See p. 118).

Discussions by George V. Parmelee, Cleveland, and Dr. George Lof, Boulder, Colo., together with the author's closure will appear in the ASHVE Transactions.

The next technical paper, **Removal of Internal Radiation by Cooling Panels,** by Merl Baker, was presented by the author (published in ASHVE Journal Section, *Heating, Piping & Air Conditioning,* November 1949).

Prof. Wayne E. Long, Austin, Tex., pointed out the value of the paper in calling attention to the means of reducing the size of equipment selected for a given cooling load, and suggested that the next step seemed to be the compilation of tables or curves from which the field engineer could evaluate the lighting load for a given installa-

tion. He also asked about the extent to which water cooled panels had been used in actual installations for removing lighting load.

A discussion from Clyde E. Bentley, San Francisco, referred to the possibility of using cooling panels in the following instances:

1. Reduction in size of air handling apparatus for a given temperature difference.

2. Reduction in air temperature difference in areas where comfort requirements are critical.

3. Reduction in size of compressor capacity requirements where design wet bulb temperature is low enough so that the use of a cooling tower is practicable.

4. There are few metropolitan localities in which it would be feasible to waste panel coolant water to obtain a saving in installed refrigeration. If refrigerant compressor plant size is reduced and a separate cooling tower used, the lowest practical initial coolant temperature would be approximately 7 deg above the design wet bulb temperature.

Because of the many factors involved, it was suggested that before a definite recommendation can be made for the installation of cooling panels, a complete analysis must be made for each particular installation.

Charles S. Leopold, Philadelphia, pointed out that 84 percent of the energy distribution of a filament lamp appears in the form of radiation. Radiation is not heat, but can elevate the temperature of a solid object, and to some extent can elevate the temperature of a gas, thus appearing in the form of sensible heat. Since filament temperature is approximately 4800 F, and since radiation is proportional to the difference of the fourth power of the absolute temperatures, it is apparent that radiant temperature is relatively independent of panel temperature when considering the temperatures of occupied spaces.

Although not in agreement with some of the assumptions used in the author's mathematical solutions, such as the use of the same shape factor for a coil filament as for an enclosing globe, and the use of the gray body concept, Mr. Leopold agreed with the general assumption that by multiple reflection substantially all of the radiant output will produce an elevation of surface temperature of the enclosing room, and the heat absorbed will either be conducted into the structure or will heat the air of the room by convection. Since the panels have a flowing coolant appreciably below the temperature of the radiating source, the heat can eventually be removed by the coolant so that the overall mathematical result can be predicted by knowing the energy distribution of the lamp.

It was also pointed out that an internal heat load having a low radiant component ultimately dissipates its energy output in heat absorbed by the walls which obtain the heat by convection.

It was also suggested that the problem can be more readily visualized by separating radiant components into those directly absorbed by the ceiling, regardless of ceiling temperature within ordinary limits, and the radiation absorbed by a cool ceiling due to the difference in temperature between ceiling and other room surfaces.

Mr. Leopold referred to his paper, The Mechanism of Heat Transfer, Panel Cooling, Heat Storage, published in the July 1947 issue of *Refrigerating Engineering*, where the percent of total energy of the lamp transferred to the ceiling by independent radiation, substantially independent of ceiling temperature, was as follows:

Clear filament lamp.....	17 percent
Silvered bowl lamp.....	35 percent
Four-tube fluorescent lamp.	21 percent
Single-tube fluorescent lamp	10 percent

Mr. Leopold also referred to time lag and cited tests conducted with a hydraulic analog in which it was shown that in the 10-hour-a-day operation of a conventional cooling system, the cooling requirements calculated by ordinary procedure were not even realized at the end of a week of operation.

The complete discussions, with the author's closure, will be published with the paper in the ASHVE TRANSACTIONS.

The last paper of the session, **Baseboard Radiation Performance in Occupied Dwellings**, by G. S. MacLeod and C. E. Eves, was presented by Mr. MacLeod (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1950).

The paper was discussed by W. A. Danielson, Memphis; E. K. Campbell, Kansas City, Mo.; P. R. Achenbach, Washington, D. C.; Warren Viessman, Port Hueneme, Calif.; M. K. Fahnestock, Urbana, F. E. Ince, St. Louis. These discussions, together with the author's closure, will appear with the paper in the ASHVE TRANSACTIONS.

Following a number of announcements, the meeting was adjourned.

FOURTH SESSION, WEDNESDAY, JANUARY 25TH, 2:00 P.M.

Pres. A. E. Stacey, Jr., called the meeting to order and announced that a check for $100.00 had just been received from the Connecticut Chapter of ASHVE for the Society's Research Fund.

He then presented L. N. Hunter, chairman of the Committee on Research, who gave a brief summary of the 1949 Annual Report of the Committee on Research (complete report published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1950.)

After presenting the report, Mr. Hunter called on Cyril Tasker who gave the Report of the Director of Research.

Joseph S. Kearney, Evanston, Ill., representing the Chicago Association of the *Heating, Piping and Air Conditioning Contractors National Association*, was recognized, and stated that the Association was pleased to present a check to the Society as a contribution to research. Mr. Hunter, in reply to a question from the floor, stated that the check was for $1000.00, and that a similar check had been received from the Association for work during the past year.

President Stacey asked Mr. Tasker to introduce the subject of Panel Heating Research being carried on at the Research Laboratory. Mr.

Tasker stated that the report would be presented in two parts, the Analytical Development, to be covered by H. B. Nottage, and the Testing Program and Results of Research, to be reported by C. M. Humphreys.

Mr. Nottage showed how an analysis was being made of the heat flow within panels, and how the analytical procedure was used to coordinate and extend the results of research. The ultimate aim of the panel heating research was to develop simple methods and charts which could be used for design purpose in panel heating installations. In the analytical procedure, studies were made of the results obtained by Prof. Carl F. Kayan, who used the Electric Analogger for studies on the output of tubes imbedded in panels.

Mr. Humphreys used a number of slides showing the type of equipment being used at the Laboratory, and gave a report of some of the results obtained with various types of panels in which different sizes of tubes were located at different center spacings.

A complete report covering the analytical procedure and the results of tests will be published in papers to be prepared by the Laboratory staff.

Prof. Carl F. Kayan of Columbia University Engineering Center, stated that he was preparing a paper on Electric Analogger Studies on Panels with Imbedded Tubes, covering the work which was being done on a cooperative research basis for the Society. He then gave a brief report of the work which had been completed, using the Electric Analogger for the prediction of the steady-state heat transfer and internal temperature distribution for a radiant heat panel with different tube spacings under the following conditions: horizontal concrete slab containing ¾ in. heated imbedded tubes, with bottom cover of 5 in. and top cover of 3½ in., and also ¾ in. (assuming constant top and bottom airside conductances).

The investigation had also been applied to the effect of *idle* tubes in panels containing *active* tubes.

Jack Everetts, John Haines and Walter Fleisher chat between sessions

Professor Kayan explained that radiant heating, by means of heated imbedded tubes in concrete building slabs having top and bottom exposed surfaces, involves an upward and a downward heat flow to the realm of lower ambient-space temperature. When heating tubes are thus imbedded within a slab structure, they set up complex heat-flow paths for which prediction of the slab temperatures and the resultant heat transfer is difficult. With the flow of a heating medium through the imbedded tubes, the temperature of the slab surfaces is increased above that of the ambient space, and thus the operating temperature-difference effect for the surfaces is created. With asymmetrical tube location, and in addition, with asymmetrical thermal-resistance conditions above and below the slab, the upper and the lower surfaces constitute, to differing extent, the effective heat transfer areas for the slab.

Particularly under these circumstances, the calculations of the heat-flow distribution between the two surfaces is, to say the least, troublesome. The present analysis is predicated on the inherent two-way heat-flow effect, and has been carried out for the two-slab structures with various active tube spaces, by means of the Electric Analogger. This involves an electric analogy procedure which is based on the similarity of the flow of heat in thermal circuits to the flow of current in electrical circuits. An electrically conductive sheet model, representative of the panel structure cross-section, is employed, and electrical measurements are made under conditions representative of thermal conditions. For all of the investigations in this study the conductivity of the concrete has been taken at k = 9.00 Btu per (sq ft) (hr) (F deg per in.), and the values of the surface conductances have been assumed as constant at h = 1.11 Btu per (sq ft) (hr) (F deg) for the top surface, and h = 0.53 for the bottom surface. Studies were made with active tube spacings of 4, 8, 12 and 16 in., and results reported in terms of 70 F ambient air with tube temperature of 120 and 170 F.

The next technical paper, **Effect of Panel Location on Skin and Clothing Surface Temperature**, by L. P. Herrington and R. J. Lorenzi, was presented by Dr. C.-E. A. Winslow (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, October 1949).

T. N. Adlam, Bethlehem, Pa. and R. G. Vanderweil, Boston, had submitted written discussions which were read by C. H. Flink, technical secretary.

Mr. Adlam expressed the opinion that high floor temperatures were detrimental to vitality of occupants. While a floor surface temperature of 72 F had been used as a maximum in England, he felt that in America 85 F was a better maximum floor design temperature (taking into consideration the fact that 77 to 78 F floor temperature would provide sufficient heat for the average outside temperatures during the winter).

In the summer tests, the temperature recorded by the globe thermometer was 75 F. This temperature had been found too high for comfort by a large number of office workers, according to Mr. Adlam's experience. It was pointed out that by experience in an office 85 × 50 ft, with windows on three sides, and equipped for use of either ceiling or floor coils, the heated ceiling did not produce the proper conditions at the floor in the vicinity of some of the windows, even though the room temperature as recorded by a globe thermometer could be maintained at a temperature of 70 to 72 F without difficulty. In this office, comfort was obtained at the same room temperature by operating both the floor coils and the ceiling coils. The best conditions

seemed to be obtained when the floor coils were operated to give a moderate surface temperature, and the additional heat required was supplied by coils in the ceiling or walls.

Mr. Vanderweil stated that in his opinion, from the comfort point of view, ceiling systems were superior to floor systems, and if the latter were used, the design temperature should be 85 F or below. Temperatures lower than 85 would require more insulation in buildings than ordinarily supplied. It would therefore be difficult to obtain sufficient heat from the floor unless the design temperature were at least 85 deg. A temperature of 85 for design purpose would be tenable since it would be necessary to operate at this temperature during only part of a season.

Mr. Vanderweil stated that the ceiling system would seem to produce conditions more nearly like those found outdoors when heat was being received by radiation from the sun.

Referring to the fact that floor temperatures in the test room were maintained at 78 F, with an outside climate temperature of 35 F and an inside temperature of approximately 74 F, Mr. Vanderweil felt that the small differential between panel and room temperature (4½ deg with floor and 11 deg with ceiling heating) seemed to indicate that the space was insulated better than would be the case with an average building. Also, since the ceiling panel - room temperature gradient was two and one-half times larger than the floor panel-room temperature gradient, it seemed possible that warmer wall temperatures were used in the case of the floor panel system.

Mr. Vanderweil also stated that one conclusion to be obtained from the paper might be that ceiling panels would be stimulating where activity and alertness are required, and that floor panels of moderate temperature might be favorable where occupants want to feel at ease. Such conditions might be obtainable by use of a heating coil placed in the ceiling of the first

Nominating Committee

(l. to r.) Seated: D. M. Mills, S. H. Downs, Joseph Davis, R. T. Kern, M. F. Blankin, E. V. Gritton, Leo Garneau. *Standing* Fred Janssen, T. F. Rockwell, William Wallace, II

floor to heat the first floor from the ceiling, and the second floor from the floor.

A discussion by C. A. Hawk, Jr. was presented by Paul S. Park, Jr., Pittsburgh. Mr. Hawk's opinion was that the conclusions drawn from the tests reported were incorrect and were invalidated by a fundamental error in the method of testing. He felt that the selection of an arbitrary temperature at the center of a blackened globe thermometer located at the center of the room as a primary condition of comparability for the whole study produced an artificial set of conditions radically different from those prevailing in comfort heating systems.

In usual practice, it was up to the owner to determine the thermostat setting which would produce comfort, and this setting would not be the same in all cases. More useful test results would have been obtained if the floor and ceiling temperatures had been selected to produce the same comfort feeling. Experience with floor panel heating systems had failed to produce any effects of discomfort or physical deterioration when such systems were properly designed and properly controlled.

Mr. Park also gave his own opinion that the tests contained a basic error in that the standard by which the two methods of heating were judged was favorable to the ceiling type of installation.

Since, with a given heating load, a floor type system will vary from a ceiling system in the division of heat transfer by convection and radiation, and since the emissivity and surface temperatures will be different, both systems should not be controlled by the same thermostat located in the same position. The location of the thermostat in the tests was apparently not ideal for the floor system, and therefore ideal comfort conditions could not be expected.

Mr. Park also questioned the correctness of the statement "in floor heating a larger proportion of heat is being lost to the environment through the legs." This conclusion was apparently based on a 1.78 deg higher mean temperature of the lower extremities, and a relatively constant mean temperature at the 36-inch level. The conclusion seemed to disregard the fact that the floor to which heat was lost by radiation was at an average of 5.74 deg higher when the floor system was used. Neither was any mention made of the higher temperature of the air to which heat was lost by convection around the feet and ankles.

Mr. Park stated that a review of the paper by several members of the faculty of a medical school resulted in a comment that the data presented in the paper did not support the conclusion of the authors that the body cannot adjust to the temperature gradients which exist on skin surfaces exposed to heat of the maximum degree mentioned in the paper, or that such gradients, if present, are harmful.

J. S. Locke, Minneapolis, stated that a conclusion might be drawn from the paper that floor panel heating should not be used in any except the mildest climates and that such a conclusion, if true, would require a considerable change in present-day practice.

Referring to Conclusion No. 3, stating that "physiological considerations are reported which support the view that floor temperatures above 75 F are not desirable," Mr. Locke stated that this conclusion appeared to be based on the reduction in vascular tone in the lower extremities which may be caused by higher temperatures and a reduction in blood supply to other parts of the body. Since different

Retiring President Stacey *(right)* congratulates President-Elect Avery

conditions of vascular tone in different parts of the body at a given time are not unusual, it seemed possible that the total amount of blood supply required for thermal balance in the body would be approximately the same regardless of which body area would be subjected to local heating so that an adequate supply would still be available for other bodily functions.

It was also observed in Table 1 that the black body temperature indicated was about 0.7 deg above ambient temperature, and also 0.7 deg above the average floor and ceiling temperatures. If the walls were below room ambient temperature, it would seem that the black body temperature should be no greater than the average of floor and ceiling temperatures, unless the room occupants exert a considerable effect on the globe thermometer. Further examination of these results was therefore indicated. It was also suggested that more data should be collected to determine whether Conclusion No.3 is justified.

Additional comments were made from the floor by Nathaniel Glickman, Chicago; Lester T. Avery, Cleveland; G. Lorne Wiggs, Montreal, and L. N. Roberson, Seattle.

Dr. C.-E. A. Winslow made several general comments on the criticisms offered and the suggestions made, and pointed out the objective of the investigation and its limitations. A complete record of the discussions, Dr. Winslow's closure and a final closure by the authors, will appear with the paper when published in the ASHVE TRANSACTIONS.

The meeting was adjourned at 4:30 p.m.

FIFTH SESSION, THURSDAY, JANUARY 26TH, 10:00 A.M.

The last session was called to order by President Alfred E. Stacey, Jr., who asked Prof. R. C. Jordan to deliver the paper, **Resistance Gradients Through Viscous Coated Air Filters**, by F. B. Rowley and R. C. Jordan (published in ASHVE JOURNAL SECTION, *Heating Piping & Air Conditioning*, December, 1949).

A written discussion by A. B. Hubbard, Bloomfield, N. J., was read by the Technical Secretary. Mr. Hubbard stated that anyone interested in air filters should study this paper carefully and consider its implications with respect to filter design, kinds of dust, suitability of test methods and applicability of available filters to a given job. He hoped that the study could be extended to test cleanable filters, to develop an ideal reproducible filter which might be used for rating tests, to make field tests of filters in actual installations, and to devise better methods of displaying results of tests.

The use of a single tube of hypodermic needle size in place of the gradient tube used, was suggested, since the smaller tube would produce less disturbance within the filter.

Since the tests indicated that each kind of dust could be made to provide a record of its own, the method used seemed to have possibilities for use in classifying natural dusts, provided an ideal reproducible filter could be devised. A comparative study which would determine whether accelerated laboratory tests would produce the same tests as long term field tests, was suggested in order to demonstrate the acceptability of accelerated laboratory tests. Comments were also offered on other methods of plotting the filter performance, the purpose being to make it possible to determine the performance of the different parts of the filter in regard to various sizes and types of dusts.

R. S. Farr, Los Angeles, pointed out that the apparatus described showed points where dust collection caused the highest resistance, not necessarily the points of highest dust collecting efficiency and loading. The method therefore would be very useful for filter design and development.

While the authors stated that the coarse media and openings on the entering side collected large, heavy particles, and that the more densely packed surfaces collected the finer, smaller particles, he felt that the collection of finer particles was due to increased energy pick-up by the particles because of increased velocity in the smaller spaces. Micro-

scopic examination of dust collected on the entering side in tests by Mr. Farr had shown a particle size distribution proportional to the type of dust fed.

Mr. Farr stated that in his opinion, partial restriction of the static hole opening would not affect the readings obtained by the instrument, but would merely affect the lag, since the tube showed static pressure and not velocity pressure. It was noted that the filters tested were of mat type and cellular type. Other types such as viscous coated impingement filters, with primary and secondary air passages, as tested by Mr. Farr, had been found to show a change in pressure drop less than 0.10 in. water column when handling even greater test loads than the filters tested.

C. B. Rowe, Madison, Wis., inquired whether the authors had made any attempt to determine whether the readings taken at the particular spot where the gradient measuring device was inserted, were representative of the entire filter.

Noting that the tests were not terminated until the pressure drop across the filter reached 1 in. of water at 300 fpm air velocity, it seemed possible that the point of uneconomical operation would be reached before the total pressure drop equaled 1 in. of water. The significant results therefore would appear to be those obtained before the resistance exceeded 0.5 in. of water.

A discussion received from R. B. Crepps, Newark, Ohio, suggested that the results determined by a special measuring device placed at one location might not be representative of the complete action of a particular filter. It seemed possible that the tortuous air stream through a filter would be altered nonuniformly from point to point as dust particles collected. Therefore studies should probably be made at several locations concurrently. This point seemed to be suggested also by the extreme care reported by the authors as necessary when inserting the special measuring device in order to obtain true values.

S. H. Downs, past president, presents gavel to President-Elect Avery

The complete discussions of the author's closure will appear with the paper in the ASHVE TRANSACTIONS.

The next technical paper, **Fitting Losses for Extended-Plenum Forced Air Systems**, by H. H. Korst, N. A. Buckley, S. Konzo and R. W. Roose (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1950) was presented by H. H. Korst.

A written discussion by D. W. Locklin, Cleveland, was read by C. M. Humphreys. Mr. Locklin mentioned a literature survey being conducted at the ASHVE Laboratory on losses in elbows as one type of duct fitting. This paper was concerned with the losses in another type, namely, branch fittings. It was suggested that additional dimensions on the drawings of fittings, shown in the paper, would be of advantage.

Several other suggestions were made for presentation of the test information, and making corrections for variations in Reynolds numbers.

The complete discussion and author's closure will appear with the paper in the ASHVE TRANSACTIONS.

The final technical paper of the session, **Vaneaxial Fan Fundamentals**, by Raymond Mancha, was presented by the author (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November, 1949).

Discussions received from C. W. Johnson, Windsor, Ont., and Ernest Szekely, Milwaukee, were read by the Technical Secretary.

Mr. Johnson noted that while the paper was excellent from the standpoint of fundamental fan laws and design, there was no indication that performance data given had been verified by actual laboratory tests conducted in accordance with the Standard Test Code for Centrifugal and Axial Flow Fans, sponsored by ASHVE and *NAFM*.

Mr. Johnson agreed with the author that the location of properly designed turning vanes in air duct bends ahead of the fan, were very important.

A question was raised regarding the possible damage that might

Past President Downs conducts installation of officers

occur by fatigue of metal in blades if pulsating pressure characteristics cause vibration of fan blades. Mr. Johnson also inquired whether the design curves given in the paper were for practical selection of fan size, and if so, what correction factors and what values of correction factors should be applied. It was suggested that *fan pressure*, where used, should be defined to indicate whether it was static or total pressure.

In Fig. 7, it was not clear whether the velocity pressure included in the total pressure was obtained by considering the velocity in the net area, that is, the wheel area less the hub area.

Referring to Fig. 8, it was assumed that a stack coefficient K set at 0.25 would require a different design of stack for each different hub ratio, thus prohibiting standards of design and making the selection a special operation for each fan.

Mr. Szekely suggested that additional data be supplied on the subject of parallel operation of fans, about which only a general statement had been made. Mr. Szekely suggested that a paper on the influence of blade angles, and number and size of blades in practical design would be of considerable interest.

W. R. Heath, Buffalo, remarked that the user could readily be confused or misled by the looseness with which the term *pressure* was used in the paper. Where reference was made to pressure, in many cases, it was not evident whether this referred to static or total pressure. The careful use of the terms was particularly important in dealing with vaneaxial or tubeaxial fans where the energy and the velocity pressure may be as high as 40 percent of the total energy, compared with centrifugal fans, where the energy and the velocity pressure would be from 10 to 15 percent of the total.

Mr. Heath felt that the discussion of series and parallel operation, as expressed in the paper, was oversimplified. Where fans are used in series or parallel, it is necessary to study the relative horsepowers, relative noise and relative stability. For the same total volume handled by fans in series and parallel, the fans in series would have twice the velocity and four times the velocity pressure of the parallel fans. Whether or not this velocity energy would be usable, would depend upon the duct system.

The complete discussions, together with the author's closure, will be published with the paper in the ASHVE TRANSACTIONS.

President Stacey expressed the appreciation of the Society to all of the authors of technicals papers, and to those who had participated in the discussions. He pointed out that all of the technical sessions had been very well attended, and that interest had been keen, and that the valuable discussions submitted had been important contributions to the value of the sessions.

Mr. Stacey announced that the final item of business to be transacted was the installation of officers which would follow immediately after the presentation of the Report of the Committee on Resolutions.

I. W. Cotton, Chairman of the Committee on Resolutions, presented the following report, which was unanimously adopted.

Resolutions

The 56th Annual Meeting of the ASHVE, January 23 to 26, 1950, has been outstandingly successful and exceptionally pleasant.

Whereas: This circumstance did not just happen, it was the direct result of careful planning and hard work. We who have thoroughly enjoyed the meeting owe marked gratitude to those who conceived and then executed the various activities and programs making up the impressive schedule we are now completing, *Therefore*,

BE IT RESOLVED: That our thanks be expressed—

1. To those resolute Society Members, beginning with our beloved Dr. Giesecke and later spearheaded by C. Rollins Gardner who insisted persistently through lo! these many years that we break all tradition and hold this Annual Meeting in the great Southwest.

2. To the membership of the Texas Chapters whose superb hospitality has proven that the prognostications of Mr. Gardner and his cohorts which might have been considered over-optimistic boasts were in reality masterpieces of understatement.

3. To the gracious distaff side of our hosts' welcoming organization for entertaining our visiting Ladies so delightfully;

4. To the National and Chapter Officers and staffs who organized all arrangements so efficiently and provided such excellent meetings, tours and diversions;

5. To the large number of patient, enthusiastic and devoted searchers for knowledge who toiled in laboratory and field to develop new data, to the authors who wrote and the speakers who presented the papers based on such data at our interesting and informative technical programs; also to the commentators whose questions, amplifications and criticisms livened the sessions and contributed to their educational value;

6. To the Dallas hostelries for sheltering us comfortably and also for nourishing us against the strenuous hazards of the countless breath-taking dashes from Adolphus to Baker and likewise from Baker to Adolphus;

7. To the Weather Bureau Meteorologist who gallantly came to the front for our hosts by ordering a liberal sprinkling of June in January—thereby quieting the fears and consolidating the front of supreme confidence which graced the personality of Mr. Gardner in extolling all the virtues of his home town, except the weather, while preparing for the Meeting;

8. And finally, in order to beat the Texans to it, we had better proclaim our own astuteness—so unmistakably demonstrated by our flocking in droves from far and wide to come, see and be conquered by this great State of Texas—in numbers large enough, in fact, to enable Dallas to break many ASHVE records and at the same time prove to the loyal sons of Texas that her greatness is fully shared by 47 friendly sister States which, joined by Canada, Mexico, France and Sweden, have sent so many Society members to enjoy her eminent hospitality.

Respectfully submitted and moved for adoption by

THE RESOLUTIONS COMMITTEE

I. W. COTTON, *Chairman*, Indianapolis, Ind.
E. K. CAMPBELL, Kansas City, Mo.
R. A. SHERMAN, Columbus, Ohio

INSTALLATION OF OFFICERS

At the request of President Stacey, S. H. Downs, past president of the Society, assumed the chair and took charge of the installation of the Officers and newly elected Council members for the year 1950. Mr. Downs presented the gavel to the newly elected President, Lester T. Avery, who accepted his new position with a full understanding of the responsibilities involved, and expressed the hope that the new Officers would be able to direct the Society so as to continue the progress made by the Society under previous officers.

Walter L. Fleisher, Past President, conducted First Vice President L. E. Seeley, Second Vice President Ernest Szekely and Treasurer Reg. F. Taylor to the rostrum, where Mr. Downs inducted each into office with appropriate remarks about the service to the Society which had resulted in their selection as Officers.

Past President G. L. Tuve presented the newly elected members of the Council, John James, Chicago; E. R. Queer, State College, Pa.; John E. Haines, Minneapolis; and G. B. Supple, Indianapolis, and with remarks on the responsibilities of a member of the Council, inducted them into office.

Mr. Downs then handed the gavel to the new President, Lester T. Avery, who proposed that outgoing Council members should be recognized by a rising vote of thanks.

The final figures were announced indicating attendance of 2157 members and guests from 46 of the 48 states and the District of Columbia. There was a large delegation from Canada and other countries represented were Mexico, France and Sweden. This registration was second only to the all time high recorded in Chicago in 1949.

As there was no further business, the president declared the 56th Annual Meeting of the Society adjourned.

We are indebted to William Wallace II, Durham, N. C., for many of the snapshots that are used throughout these Proceedings.

CHUCK WAGON DINNER

The Chuck Wagon Dinner proved to be so popular that the attendance which reached 1400 was more than twice that estimated in advance by the committee. A colorful Texas atmosphere was provided by the number of people who wore cowboy dress outfits. Sombreros with hat bands bearing the ASHVE initials were distributed to guests.

Following the cafeteria style dinner of barbecued roast beef, beans, pie and coffee, entertainment was provided by a Mexican orchestra. Later in the evening, a special

Presentation of Ten-gallon hats and Honorary Deputy Sheriff Commissions to Alfred E. Stacey and Lester T. Avery at Chuck Wagon Party, Fair Park, Dallas

A merry group at Chuck Wagon dinner

Mr. and Mrs. W. A. Kuechenberg and Mr. and Mrs. C. A. Imming in Chuck Wagon style

square dance orchestra together with a troupe of professional square dance performers staged a demonstration of square dancing. The audience was then invited to participate in square dancing which continued until midnight.

BANQUET

The Annual Banquet, which was held in the Grand Ballroom of the Baker Hotel, was attended by 850 members and guests. C. Rollins Gardner, the general chairman of the Committee on Arrangements, was the toastmaster.

A Memory Book was presented on behalf of the Society to Past President G. L. Tuve by Past President W. L. Fleisher, who reminded Professor Tuve that the Book would be enjoyed by his children's children who would find in it evidence of his many and important activities in the Society and his widespread travels as President.

A Past President's emblem was presented to the retiring President Alfred E. Stacey, Jr. by Mr. Fleisher. Mr. Fleisher referred to the fine service which Mr. Stacey had rendered to the Society not only as president but in previous years when he had been Chairman of the Committee on Research and active on many other Society committees.

F. Paul Anderson Medal

Dr. C.-E. A. Winslow, Past President of the Society received the F. Paul Anderson Medal from President Stacey in recognition of outstanding work in the field of heating, ventilating and air conditioning. In presenting the Medal, Mr. Stacey gave the following citation:

The award of the F. Paul Anderson Medal is made this 25th day of January, nineteen hundred and fifty, at the 56th Annual Meeting of the Society in Dallas, Texas, to you Dr. Charles-Edward Amory Winslow, Professor Emeritus of Public Health, Yale Medical School, New Haven, Conn., by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS; As a sanitarian you have had a long and varied career as a distinguished scientist, educator, author and consultant. You have been the recipient of many honors and awards in your field of endeavor. The award given you today by this Society, which you served so well as President in 1945, is in recognition of your outstanding contributions to the arts and sciences of heating, ventilating and air conditioning, as a physiologist, research director, teacher, advisor and author and for your distinguished services in advancing the knowledge of the relationship and understanding of man and his environment by the engineer and the physiologist.

The Fearful Era

The principal address at the banquet was given by Dr. Umphrey Lee, President of Southern Methodist University, who used as his subject, *The Fearful Era*. Dr. Lee said the country was now in its "fearful era," brought on by the scares of the depression and the war.

"We've never lived with longtime fears before, but either we live with them now or we do not live at all.

Ready for the Banquet

C. Rollins Gardner, toastmaster, introduces honored guests at speakers' table

President Stacey presents F. Paul Anderson Medal to Dr. C.-E. A. Winslow

Most of our people are afraid somebody is going to try to take our power away from us, but the danger actually lies in what we will do with our power when we finally realize just how great it has become."

He warned engineers that as professional men, they had better wake up to their responsibilities in society by learning more about their government.

He asked for a more lenient attitude toward youngsters, saying that many of the problems would be solved by them.

"You'd be surprised how well this generation is getting along," he explained. "We had some university scholarships open up last year, with which we could pay tuition for deserving sophomores. But 70 percent of the students said they could make it through school without help.

"Give a little thanks in your prayers that your kids have got what it takes," he added. "They were brought up in the depression and the war, but if you give them half a chance, they'll do at least as well as you and I have done."

At the close of the banquet, each of the ladies received an orchid which had been flown in from Mexico by the American Air Lines. After the banquet, the ballroom was cleared for dancing and music was provided by Hugh Fowler's orchestra.

A special feature of the printed banquet program was the Texan's map of the U.S.A. which left very little space for the 47 unimportant states bordering on Texas.

LADIES

The invitation to Texas met an overwhelming response from the ladies and 462 registered from all parts of the United States, Canada, and Mexico.

The Ladies Committee was always in evidence and those ladies of the North Texas Chapter who served as hostesses made the visitors welcome and saw to it that they enjoyed their stay in Dallas.

The program for the visiting ladies commenced with a tea on Sunday afternoon, January 22, when a get-together was held in the Texas Room of the Baker. The Baker was headquarters for ladies' activities and many attended the welcome luncheon on Monday, the 23rd, at noon. During the afternoon they enjoyed a lecture by Joseph Linz on fine jewels and witnessed a fine display of valuable gems.

On Tuesday, the 24th, there was a special ladies' luncheon and style show in the Mural Room at the Baker and an excellent show was put on through the courtesy of Neiman-Marcus Co. of Dallas.

On Wednesday 160 ladies enjoyed a theater party and saw Margo Jones' presentation of *My Granny Van* at Theater 50 at the State Fair Grounds.

In addition to the special ladies' events the general functions were well attended by the ladies, such as the Chuck Wagon Dinner, the Annual Banquet, and some were in evidence at the Exposition.

INSPECTION TRIPS

Interesting Inspection Trips arranged by the Special Events Committee were well attended and greatly enjoyed. Some of the installations visited were as follows:

Alford Refrigerating Warehouse, where the installation consisted of 1100 tons of refrigeration operating on natural gas and using horizontal compressors. Many unique features of the building construction were inspected by the visitors. The Alford

The 56th Annual Banquet, Baker Hotel, Dallas as seen from the speakers' table

Warehouse is the largest refrigeration warehouse in the world.

The Kirby building was unique in that all of the air conditioning equipment, including boilers had been installed on the roof of the building in order to make space in the basement and lower floors available for income purposes. This installation employed 350 tons of refrigeration.

The Lone Star Gas Company building is equipped with a high velocity air conditioning system and employs 600 tons of absorption refrigeration.

Other installations which were examined by some of the members were the Dallas Morning News Building, one of the newest and most modern newspaper buildings in the South and the Mercantile Bank Building where a high velocity air conditioning system with steam-driven centrifugal refrigeration equipment was installed and refrigeration requirement was 850 tons in this building.

EXPOSITION

The Southwest Air Conditioning Exposition held at Dallas, Texas, January 23 to 27 was successful from every viewpoint. Attendance was high, the location inviting to hundreds of visitors, who had not had previous opportunity to view such a display. Many such had no conception of the size of the industry, the scope of its technology or the immense variety of mechanisms employed in equipment for heating, ventilating and the processing of air for health protection and industrial needs. Registration at the exposition during the week was over 8,000.

Exhibits embraced the complete catalog of equipment available and in process of introduction for performing the various functions of air conditioning in all its ramifications. Leading manufacturers in the field were well represented, as were the great number of smaller producers of specialties. Local manufacturers were also in evidence, several making their bow to the industry with new products and services.

Innovations were numerous, reflecting the rapid evolution of design in air conditioning installations. These ranged from single purpose devices to completely packaged and self-contained units. An outstanding general impression of the exposition as a whole is that the most promising innovations were along the lines of heating and cooling dwellings, particularly individual rooms and small homes, self-contained or free standing units for stores, shops and other commercial uses, and further elaborations in the comprehensive systems used for processing air in industrial plants.

The ASHVE booth at exposition

New Things Numerous

Among the many newsworthy items viewed for the first time were an adaptation of the venetian blind to a full-vision, full-ventilating window; a self-contained wall heater, and, what was said to be the world's largest fully automatic rotary oil burner.

A number of manufacturers of heating equipment are concentrating on space-saving designs. New models in this sector appeared at many booths at the exposition. Space-saving furnaces for under floor spaces are figured for minimum height. Equipment of this description is offered for industrial, as well as domestic applications, where they may serve as suspended space heaters. The unit in question is equipped with two air filters and with the burner shut down may be used as an air circulator during warm weather.

Another display included ½ and 1 hp window type room air conditioners; a remote floor-type room air conditioner; three and 5 hp packaged air conditioners; a 10 ton packaged air conditioner, reciprocating compressors ranging in capacity from one to ten horsepower; and cooling coils. Preview models were shown by one manufacturer, this latest development being a compact, self-contained air conditioner for medium-sized commercial applications.

New developments in filtration seen for the first time at Dallas included the appearance of an electrostatic precipitator, in a line already well known, which now appears in packaged form, completely self-contained.

Tagged with a graphic new label, and exhibited for the first time was a "heater-cooler" furnace, a twin-unit design incorporating a compressor type refrigerating unit and a gas furnace.

As was expected, gas heaters were numerous at the exposition. Because of the steadily increasing demand for its steel boiler, one manufacturer developed and introduced a de luxe model at Dallas.

Another manufacturer of gravity and forced warm air furnaces showed a compact packaged gas furnace, as well as an improved gas

conversion burner, a type of equipment that is coming into greater demand with the rapid projections of natural gas distribution into new territory.

Individual specialties were featured in great number at the exposition. A novel application of radiant heating was a vented "infrared ray" unit gas heater for commercial applications. Simplified by the elimination of piping and blowers, these units are hung eight or ten feet above the floor over machines, merchandise stocks, or counters where cold spots are apparent.

Baseboard heating, which continues to attract a great deal of attention, was demonstrated in several ways at the exposition. One manufacturer showed a new-style cover for securing a balanced flow of radiation and convection. This provides constant radiation, but controllable convection by means of adjustable louvers behind slotted openings in the cover.

Air distribution for the more elaborate heating and ventilating systems continues to produce improvements. One of the specialists in this field has come forward this year with a new universal diffuser, which provides three distinct methods of distribution.

Many exhibits of materials, supplies and equipment that are required for the installation of air conditioning equipment constituted an important segment of the exposition. New this year is an aluminum faced fiberglas insulating blanket for gravity and forced warm air furnaces and packaged unit space heaters.

There was a profusion of instruments for indicating, recording and operating controls, revealing great progress in this highly active field.

Many instruments have been developed especially for use by heating and ventilating engineers and contractors in field work, and the exposition offered a number of worthwhile innovations of that kind. Illustrative was the new surface pyrometer.

The Society's display attracted much attention and was favorably regarded. Members of the Research Laboratory staff were on hand to demonstrate and explain the use of the instruments which were shown.

The Exposition was under the management of the International Exposition Co., Grand Central Palace, New York, with Charles F. Roth manager and E. K. Stevens associate manager.

OLIVER J. PRENTICE HONORED AT DINNER

Oliver J. Prentice, Life Member of The ASHVE and past president of the Illinois Chapter, was honored at a dinner January 5 at the *Chicago Bar Association* marking his retirement as director of publicity and public relations of the C. A. Dunham Co., Chicago. Friends and associates of "O.J." from the C. A. Dunham Co. (with which he had been connected for 30 years), fellow-members of the important Illinois committee of the *Chicago Association of Commerce and Industry* (of which Mr. Prentice is a life member and past chairman), representatives from the *National Association of Building Owners and Managers* (to which Mr. Prentice has belonged since 1929), and personal and business friends of the guest of honor attended the affair.

F. E. Schmidt, vice president of the company, served as toastmaster, and appreciative addresses on "O.J.'s" many contributions to his company, the heating industry, and to church and other *after-hours* work were made by officers of the C. A. Dunham Co., H. S. Marshall, president, A. J. Dickey, president and general manager of the Toronto office, and by Louis A. Bowman, a friend of Mr. Prentice's for over 60 years. L. D. Mandell, Jr., vice president of the company, read a few of the dozens of congratulatory letters and telegrams which had arrived from all over the country and from Canada and England.

Following the dinner, Mr. Prentice left by air for a brief vacation in Florida, but took time out from this vacation to meet with his many friends and fellow members of the ASHVE in Dallas where he was a familiar figure at the 56th Annual Meeting.

H. S. Marshall, president of C. A. Dunham Co., presents a copy of a resolution adopted by the company's board of directors to Oliver J. Prentice upon his retirement from 30 years of service as director of publicity and public relations

Summary of Chapter Meetings

Chapters Hold Joint Meeting With Texas A & M Student Branch

(L. to R.) R. N. Hughes, president, Texas A. & M. Student Branch, H. V. Keepers, Prof. L. S. O'Bannon, sponsor of Student Branch, W. Q. Scott, vice president, Texas A. & M. Student Branch

Fire Prevention Responsibility of the Air Conditioning Engineer was the subject that was discussed by H. V. Keepers, assistant manager, Fire Prevention and Engineering Bureau of Texas, at the annual joint meeting of the Southwestern Chapters and the Texas A & M Student Branch of the ASHVE, on December 13 at the Fin Feather Club, Bryan, Tex. It was the fourth annual joint meeting to be held by the Texas A & M Student Branch. Mr. Keepers discussed the fire hazards that are induced by the improper installation of an air conditioning or heating system. He also pointed out that smoke carried from some remote fire through the duct system may result in a great amount of damage in some business establishments, such as clothing stores. The importance of the proper application of the *Standards of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, Heating, Ventilat-*

Joint meeting of the Southwestern Chapters and the Texas A. & M. Student Branch

ing, Air Conditioning, Blower and Exhaust Systems was stressed by Mr. Keepers.

This meeting was held in conjunction with the North Texas, South Texas, Southwest Texas, and Shreveport Chapters, and also the University of Texas Student Branch. The purpose of the joint meeting is to give the student and the practicing engineer a chance to meet and develop an acquaintance which later may be useful to each. Through informal talks, the student learns what is expected of him when he goes to work in the field of air conditioning and he learns of employment prospects in the field.

• **BALTIMORE**—January 18, 1950. The Baltimore Chapter held its January meeting at the Engineers Club with Pres. E. L. Crosby presiding. Before introducing the guest speaker, President Crosby summarized the results of the Board of Governors meeting which had just adjourned. Dr. W. W. Guernsey, director of research, Consolidated Gas & Electric Light & Power Co. of Baltimore, was introduced and addressed the meeting on the subject of *Corrosive Effects on Metals*. He covered the basic chemical reactions and electromotive forces causing metallic corrosion and different characteristics and then discussed oxide and sulphide coatings and their function in the prevention of corrosion. A discussion followed which centered principally around various methods of treating water, particularly to prevent corrosion of pipes in closed heating systems and cooling water systems. Attendance 33. Attendance ratio 0.40.*

• **CINCINNATI**—January 3, 1950. K. B. Little, president, opened the January meeting at the Engineering Society Headquarters with a motion to omit the reading of the previous minutes. Myron Downs, of the Cincinnati Planning Commission, was introduced by T. D. Reiley. Mr. Downs, associated with the City Planning Commission for many years, discussed the past, present, and future plans for city development. With the aid of slides, he presented, in an interesting manner, the purposes of the Planning Commission and its duties, and discussed in detail the expansion of the city, its roadways, water lines, as well as its beautification. He emphasized the difficulties encountered in such planning and the tremendous cost involved. Considerable discussion followed Mr. Downs' talk since it dealt with problems vitally affecting everyone living in Cincinnati. Attendance 35. Attendance ratio 0.29.

• **CONNECTICUT**—January 12, 1950. C. F. Neergaard of Neergaard and Craig, hospital consultants, New York, N. Y., gave an interesting talk on the engineering design of heating, ventilating and air conditioning for hospitals. He presented some interesting facts on boiler horse-power required and fuel cost per bed. Mr. Neergaard gathered his information from his wide experience in consulting work on 286 hospitals in the United States, South America, and Europe. D. M. Hummel, the chapter's representative on the Connecticut Technical Council, announced that a refresher course is to be started next September in New Haven Junior College. This course is to cover engineering fundamentals. The various committee chairmen presented reports and the chairman of the meetings committee announced that the next meeting would be held in Meriden. Attendance 74. Attendance ratio 0.34.

• **ILLINOIS**—January 9, 1950. At the January meeting, at which Pres. J. S. Kearney presided, W. A. Kuechenberg announced plans relating to transportation to the Annual Meeting in Dallas. At the completion of committee reports, H. F. Stamps, chairman of the meeting, introduced Colonel Roger Sherman Hoar as speaker of the evening. Colonel Hoar explained his position as a patent attorney and discussed many of the problems facing the inventor and patent lawyers. He discussed in detail the meaning of the terms *anticipation* and *domination* as they are used in the patent field, and further clarified the problems of patent interpretation and determination. Colonel Hoar also explained the limitations and scope of various types of patents and suggested in all cases that claims be simplified where possible to avoid undue limitations. In completing his discussion, he listed a number of popular misconceptions concerning patents and their value. According to the report by G. W. Bornquist, secretary, this meeting was an unusually interesting one. Attendance 106. Attendance ratio 0.24.

• **IOWA**—January 10, 1950. D. E. Wells, president, called the January meeting to order at the Elks Club. M. E. Gould reported on the short course scheduled at Iowa State College, March 20-22. Before delivering the talk of the evening, Carl F. Boester, housing consultant, Purdue Research Foundation, Lafayette, Ind., and member of the Society's Committee on Research, gave a preliminary talk outlining some of the recent changes in the Society's By-Laws and explained the reason for such changes. He also discussed Society problems in general. Mr. Boester then gave an interesting talk on the use of high temperature hot water district heating, using water temperatures of 450 deg. He pointed out some of the problems involved in the design of the sys-

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

tems and indicated that water velocities of from 6 to 7 fps were used over the surfaces increasing the heat transfer. He also pointed out that smaller pipes are used because of the high velocities and that a housing project of over 1,000,000 Btu requirement could be handled through a 1 in. line. Following a discussion, the meeting was adjourned. Attendance 26.

• **NEW YORK**—January 16, 1950. At the January meeting, following the routine business, Pres. H. S. Johnson turned the meeting over to R. L. Stinard, program chairman, who announced the meeting would be devoted to the showing of three movies, arranged through the courtesy of A. A. Bearman, past president of the chapter. The members then settled back to enjoy the showing of *Wings to Alaska, Story of Lubrication* and *Open Pit Mining of Nickel Ore*. The program was concluded with a movie featuring Abbott and Costello, followed by adjournment. Attendance 55.

• **NORTHEASTERN OKLAHOMA**—January 10, 1950. Chapter members met at Smith's Restaurant where dinner was served prior to the meeting, at which Pres. A. D. Holmes presided. Following the business meeting R. F. Shoemaker introduced the guest speaker, E. A. Rapp, district representative, General Electric Co., Dallas, who gave a talk on *Air Conditioning of Multi-Room Buildings*. After an interesting question and answer period, the meeting adjourned. Attendance 19. Attendance ratio 0.41.

• **ONTARIO**—January 11, 1950. A. J. Strain, president, presided at the January meeting held at the Royal York Hotel. N. W. Kingsland, chairman of the On-to-Dallas committee, announced that 23 Ontario chapter members and 5 Montreal chapter members had planned to attend the Annual Meeting in Dallas. J. H. Fox made a progress report on the forthcoming Semi-Annual Meeting scheduled for Lake Muskoka in June. W. H. Paterson, chief engineer, Toronto Transportation Commission, then addressed the meeting on The New Rapid Transit Subway Project for the City of Toronto. Mr. Paterson illustrated his talk with slides showing the new design of cars and underground stations as well as stations above ground. Attendance 128. Attendance ratio 0.43.

• **PITTSBURGH**—January 9, 1950. Before turning the meeting over to the *History Committee*, T. F. Rockwell, chairman of the by-laws committee, submitted his report followed by a discussion on the Society's new By-Laws. Pres. H. J. Kirkendall then presented a Life Membership Certificate to T. M. Dugan, who very ably expressed his appreciation. President Kirkendall then turned the meeting over to the *History Committee* and the 30 years of the chapter's history was then narrated.

J. F. Collins, chairman of the committee, gave his findings of the chapter's history from 1919 to 1934. Mr. Collins then gave the names of the presidents who served during these years.

P. A. Edwards then took up where Mr. Collins left off and traced the history from 1934 to the present, naming the presidents who served these last years. At the conclusion, H. Lee Moore presented each of the past presidents with a pin showing the year in which he served. There were 18 past presidents in attendance.

A rising vote of thanks was given to the *History Committee* for their efforts in assembling the historic material so completely. Attendance 47. Attendance ratio 0.89.

• **ROCKY MOUNTAIN**—January 4, 1950. Frank Bobier, chief mechanical and electrical engineer, T. H. Buell Co., Denver, Colo., was introduced by R. W. Petersen as the featured speaker. Mr. Bobier spoke on the latest equipment and methods of heating and air conditioning being utilized in the new ultra-modern building of The Denver Post, which is nearing completion. He described the applications of the equipment for the different sections of the building, going into detail on the printing room, the rotogravure section, with its explosion hazard due to naphtha vapor; the linotype department with its tremendous heat release; and the stereotype department with a similar condition. The mailing room with open chutes, floor, ceiling, and roof exposure presented a problem that was solved with floor coils, direct radiation, and the use of hot and cold air supplied by ducts with connecting mixing dampers. He then gave a description of the sidewalk snow melting, for an area approximately 550 ft by 15 ft with an analysis of electric cable against hot water coils, and the factors that led to the use of electric cable.

A lengthy discussion period followed and many interesting angles were brought out. After a vote of thanks to Mr. Bobier, the meeting adjourned at 10:45 p.m. Attendance 51. Attendance ratio 0.32.

• **VIRGINIA**—January 11, 1950. The meeting in Norfolk was called to order by J. E. White. Following the report by the auditing committee, the board of tellers announced the election of the following officers: *President*—W. P. Robinson, *Vice President*—J. F. Boyenton, *Secretary*—D. E. Phillips, *Treasurer*—J. E. Harding; *Board of Governors*—E. D. Duval and J. J. Shanahan. Mr. White, retiring president, expressed his appreciation for the splendid cooperation he received during his almost two years in office and then turned the meeting over to Mr. Robinson, who asked for the

continued cooperation of the members. Mr. Boyenton told of the troubles the chapter encountered in the past few years and how they were handled by Mr. White. In conclusion, he presented Mr. White with a past president pin for 1949. An open discussion period followed and the meeting adjourned at 9:25. Attendance 9. Attendance ratio 0.33.

• **WASHINGTON, D. C.**—January 11, 1950. A joint meeting of the Washington-Baltimore section of *ASRE* and the Washington, D. C. chapter of the ASHVE was held at Hotel 2400 with P. R. Achenbach, president of ASHVE chapter, opening the meeting. All business was dispensed with and President Achenbach introduced J. H. Walker, mechanical engineer of the Applied Physics Laboratory, The Johns Hopkins University, who spoke on the subject *Jet Propulsion and Supersonic Flight*. Mr. Walker described the types of jets and rockets and told of his laboratory's participation in V-2 rocket tests at White Sands, New Mexico as well as in the launchings from Naval vessels. His talk was augmented with sound films. Mr. White, an authority on this subject, gave an excellent talk and was able to hold the interest of his audience in this highly technical discussion, although foreign to most of those present. A lengthy question and answer period ensued and a rising vote of appreciation was accorded Mr. White before adjourning the meeting. Attendance 40. Attendance ratio 0.35.

• **WESTERN MICHIGAN**—January 9, 1950. *Atomic Energy* was the topic of a discussion at the January meeting held in Grand Rapids with John Alexander presiding. K. E. Robinson, program chairman, introduced two speakers, D. E. Van Farowe and R. S. McClintok, each of whom used slides to illustrate his phase of the atomic energy discussion. An open forum followed. Attendance 55. Attendance ratio 0.31.

• **WESTERN NEW YORK**—January 16, 1950. Before opening the meeting, Pres. F. J. Weber announced that Roswell Farnham would be delegate to the Dallas meeting and Joseph Davis would be alternate.

The chapter members were welcomed by Bill Meiter of the Worthington Pump & Machinery Corp. plant, where dinner was served with Paul Wyckoff and A. C. Ross as hosts. After dinner, Mr. Ross gave a brief talk in which he related that the original founder of the corporation started the business by building a steamboat for the Erie Barge Canal. Following his talk the meeting broke up into small groups of eight men and each group was conducted on an extensive tour of the Buffalo Works Plant. Attendance 65.

STUDENT BRANCHES

▲ **CCNY**—January 4, 1950. Reports were submitted by the various committee chairmen and the financial statement for the semester was read by T. C. T. Roberts, treasurer, followed by the election of officers for the Spring 1950 semester. After the election, the officers-elect were given a summary of their duties by the retiring officers. The new officers made plans to meet before the start of the new semester in order to have a definite program ready for presentation at the first meeting of the new term. Attendance 32. Attendance ratio 0.64.

▲ **OREGON STATE COLLEGE**—January 18, 1950. The first meeting of the Winter term was a joint meeting with *ASME*, and was called to order by Glen Kerrebrock, president of *ASME*, in Dearborn Hall. M. B. Larson, president of ASHVE Student Branch, was introduced and spoke on the coming meeting of the Oregon section in Portland. The speaker of the evening was Mr. Fry of Owens-Corning Fiberglas Corp., Portland, who related the history of Fiberglas and showed samples of insulation and textiles made from it. He explained its uses and method of manufacture. His talk was followed by two movies, one *Watts in Glass*, showing the methods of manufacture and the uses of electrical insulation; the other was a cartoon *The Wayward Btu*, a story dealing with heat insulation. Attendance 30. Attendance ratio 0.91.

▲ **PURDUE UNIVERSITY**—January 11, 1950. C. M. Sallman, chairman of the Student Branch, opened the meeting in the Mechanical Engineering Building and turned the gavel over to the incoming chairman, D. M. Williams. The guest of the evening, Dick W. Whittington, president, Whittington Pump & Engineering Corp., Indianapolis, Ind., opened his remarks on *Vacuum and Vacuum Heating Systems* by stating that there was not enough information on this subject taught to college students. The speaker also stated that air mixed with the water and lift pockets cut the efficiency of the heating system a great deal. Mr. Whittington further explained the workings of a single and double pipe vapor heating system and all the difficulties involved in the design of new systems and the converting of the old units. After expressing his gratitude to Mr. Whittington, on behalf of the Student Branch, Mr. Williams officially closed the meeting. Attendance 51. Attendance ratio 0.36.

▲ **UNIVERSITY OF DETROIT**—January 10, 1950. Pres. Louis Blanchette held an informal meeting and introduced G. H. Whalen, representative of The Trane Co., La Crosse, Wis., who spoke on *Air Conditioning of Multi-Room, Multi-Storied Buildings*. His talk covered the central system, the modified unit system and unit system of air conditioning. Attendance 33. Attendance ratio 0.32.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month, 99 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by March 25, 1950, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

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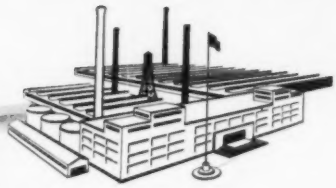

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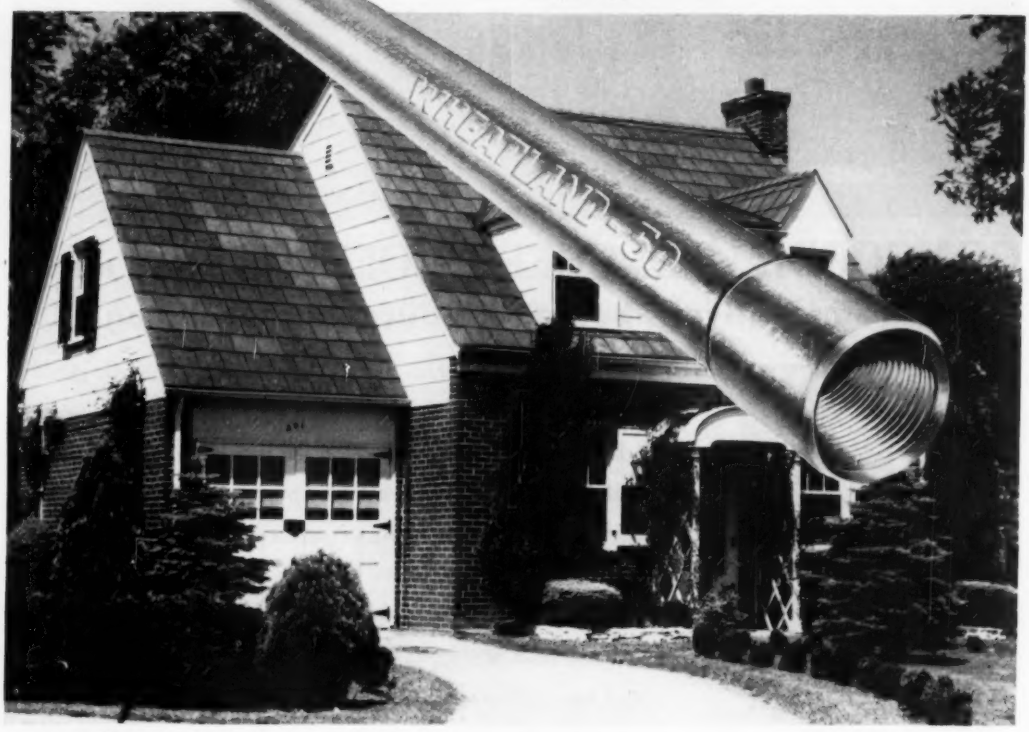

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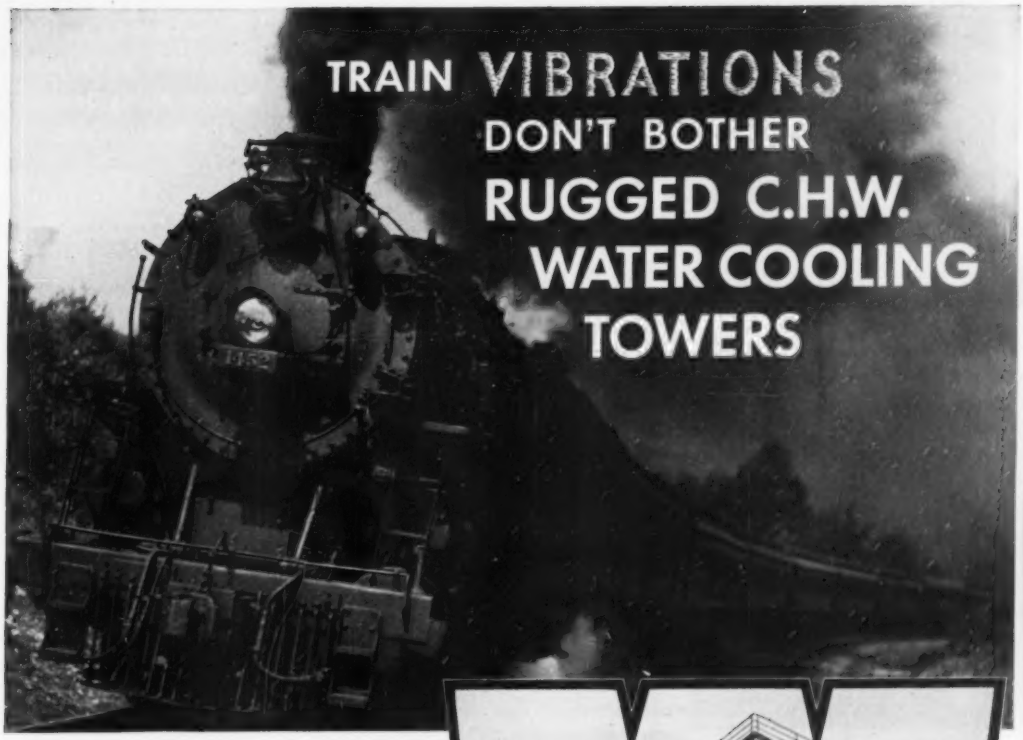


TRAIN VIBRATIONS DON'T BOTHER RUGGED C.H.W. WATER COOLING TOWERS

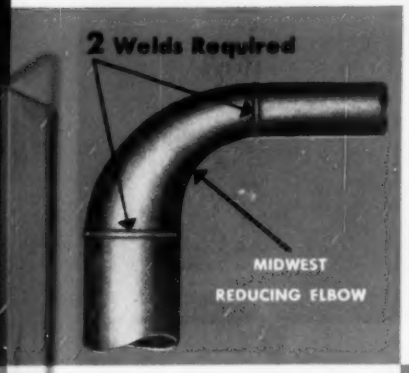
Speeding express trains and thundering freights can cause serious vibrations with damaging effects on equipment located nearby. Here's a C. H. W. water cooling tower installed so close to one of the country's heaviest traveled railroads that passing trains nearly knock your hat off. This tower of The Bayer Company, aspirin manufacturers at Trenton, N. J., is as good as the day it was built. And there are many good reasons why they haven't had any "headaches" with it. In a C. H. W. cooling tower you get a sturdy structure, assembled by experts, with redwood members rugged enough to withstand stresses, strains and vibrations (caused by trains or most anything else up to hurricane winds of 100 m. p. h.). Wood fill is of sufficient size and weight to "stay put" without the use of nails, and vertical members are securely bolted. A distorted distribution system or wood fill "out of place" affects the efficiency of the tower—hence the reason for C. H. W.'s "vibration proof," rugged construction. For other exclusive features of C. H. W. towers, write for literature.

C. H. WHEELER MANUFACTURING CO.
1826 Sedgley Avenue, Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C. H. Wheeler
SINCE 1903

STEAM CONDENSERS · WATER COOLING TOWERS
EJECTORS · STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA

SAVE MONEY and get BETTER PIPING by using the MIDWEST REDUCING ELBOW



Instead of a Standard Elbow and a Reducer

The Midwest Reducing Elbow saves more than a third of the welding when used instead of a standard elbow and reducer. In addition to a substantial saving in time and money, it provides much neater appearance and insulation is easier. The gradual reduction, smooth curve and absence of abrupt neck reduce the pressure drop and turbulence. Center-to-end dimensions are the same as for ASA standard elbows.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows . . . unusual dimensional accuracy and uniformity, stress relieving, beneficial effect of working metal in compression, etc.

The Midwest Reducing Elbow is only one of many fittings developed by Midwest to reduce the cost and improve the quality of welded piping. You will find it advantageous to get in touch with the Midwest Distributor near you whenever you need welding fittings.

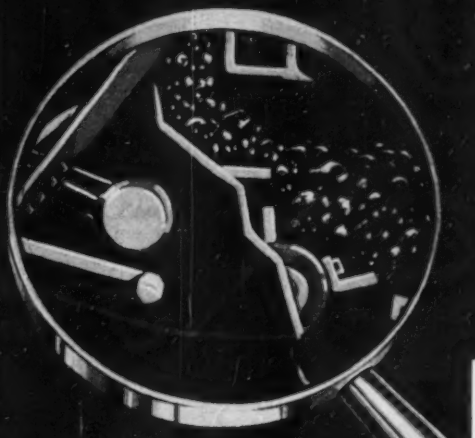
MIDWEST WELDING FITTINGS
Improve Piping Designs and Reduce Costs

MIDWEST PIPING & SUPPLY COMPANY, Inc.

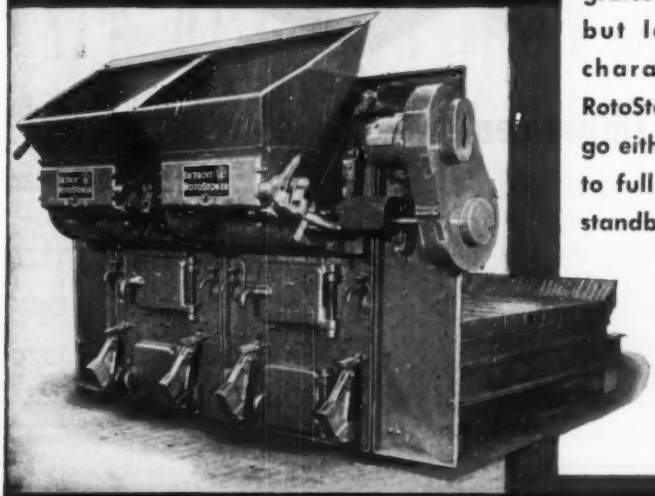
Main Offices: 1450 South Second Street, St. Louis (4), Mo.
***Sales Offices:* New York (7), 30 Church St.**

Chicago (3), 79 West Monroe St. • Los Angeles (33), 520 Anderson St. • Houston (2), 229 Shell Bldg. • Tulsa (3), 533 Mayo Bldg. • South Boston (27), 426 First St. • Distributors in Principal Cities.

It's the OVERTHROW ROTOR



DETROIT ROTOSTOKER



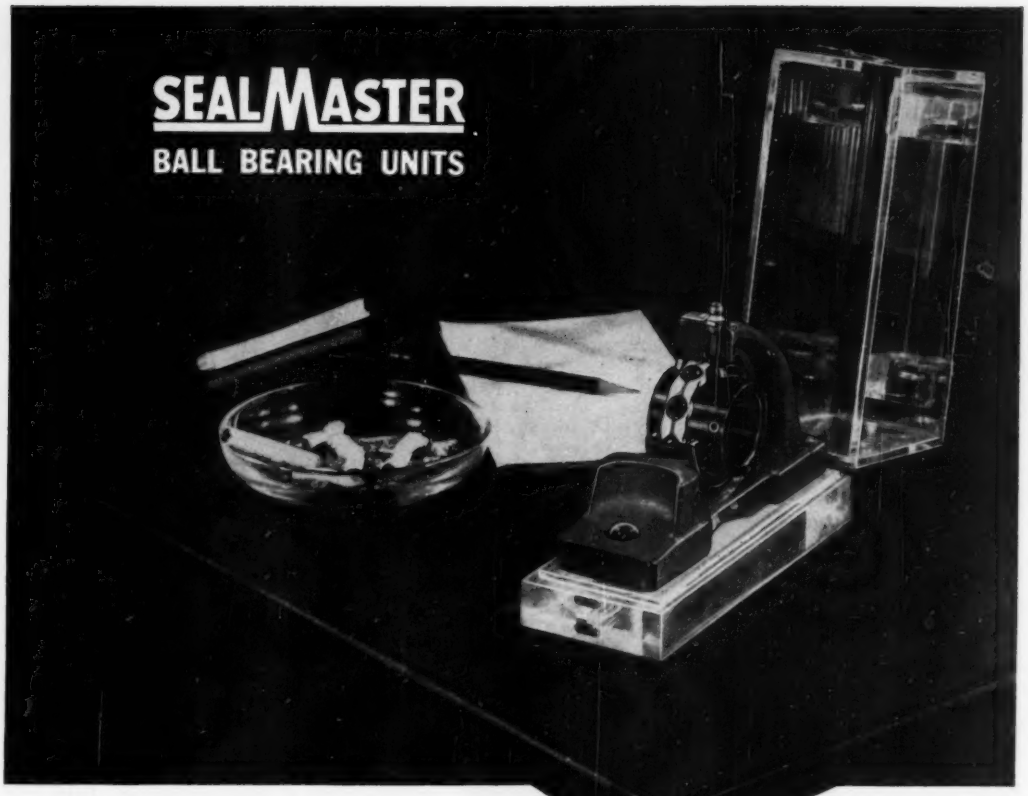
A spreader stoker with an **OVERTHROW ROTOR** that assures dependable and uniform fuel distribution. Fuel is burned partially in suspension and partially on the grates with a comparatively thin, but level fuel bed. Burning characteristics are such that RotoStoker equipped boilers can go either from a banked condition to full load—or from full load to standby in a few minutes. Banking losses are negligible, as only a small amount of coal is carried on the grates at any time.

Write for Bulletin.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities • Works at Monroe, Michigan



Beginning of An Important Product Improvement

No machine can be better than its bearings! Bearings are basic . . . to long life, to dependability . . . to the performance and reputation of the product. In the product planning stage be sure to investigate the advantages that SEALMASTERS exclusive combination of features can give to your product.

It's no accident that a great many of the foremost machine manufacturers are specifying SEALMASTER Ball Bearing Units. Pillow Block (shown above), Cartridge, Flange, Flange-Cartridge, Take-Up and Hanger Units, as well as many special types, are illustrated in the SEALMASTER catalog. Have your secretary write for it today.

Bearing Division
STEPHEN S-A DAMSON MFG. CO

47 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

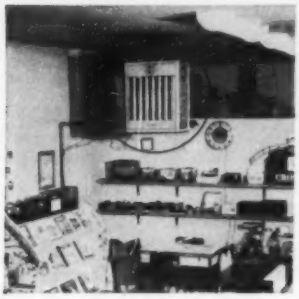
5 Reasons Why You're Better Off with SEALMASTERS

1. **Permanently Sealed**
   Felt-lined steel flinger rotating in labyrinth, prevents entry of dirt and retains proper amount of lubricant.
2. **Self-Aligning!**
   Bearing unit, with seals independent of the housing, can align itself in any direction without seal distortion.
3. **Prelubricated**
   The bearing chamber is filled with the proper amount of grease before bearing leaves factory.
4. **No Housing Wear!**
   Patented locking pin and dimple prevent rotation of outer race in housing, thus eliminating housing wear . . . permit shaft alignment and position unit for relubrication.
5. **Floating Retainer!**
   Ball retainer is designed to float on ground inner surface of outer race . . . traps lubricant and prevents churning.

Invite the SEALMASTER engineer to give your company the full story on SEALMASTER bearings. If you have a special bearing problem . . . put it up to him for recommendation.

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

Airport OR APPLIANCE STORE



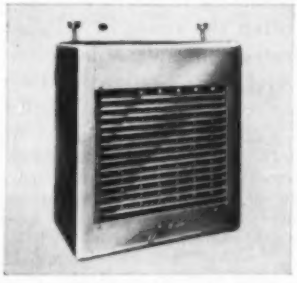
★

Above: partial view of Moisant International Airport, New Orleans. Air line passengers benefit from both air ventilating and heating. Janitrol Unit Heaters installed by American Heating and Plumbing Company.

★

Small Janitrol Unit Heater provides clean automatic heating for customers' comfort in Cincinnati appliance store. Installation is typical of hundreds made in this city by the A. H. Gerdsen Company.

JANITROL UNIT HEATERS provide the advantages of clean, automatic gas heat at low installation cost



Janitrol Unit Heaters equipped for natural, manufactured or L-P gases, range in capacity from 50,000 to 450,000 B.t.u. per hour input ratings. Suspended and floor models, and types for filtered air comprise the complete line for every commercial and industrial heating requirement.

First question, on heating plans, like everything else these days is usually . . . *"What's the cost?"*

While heating costs include much more than the original installation because of fuel consumption, combustion efficiency, flexibility, maintenance and other factors . . . a *properly engineered* installation of Janitrol Unit Heaters will usually meet all requirements *and cut costs.*

Whether it's a huge building requiring several million BTU/hr. or the corner store with a single Janitrol Unit Heater, installations are made without the expense of installing extensive duct work.

With unit heaters, heat is directed *where* it's needed and *only* when it's needed, an important factor in operating economy.

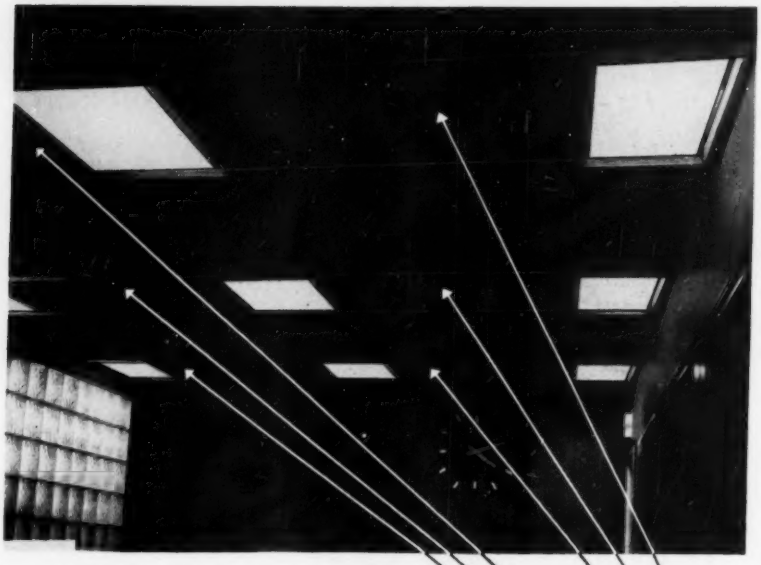
If building plans call for air conditioning, specially designed Janitrol Gas-Fired Unit Heaters can be quickly installed in the air conditioning duct work. This eliminates duplicating duct work, pipes and blowers, for summer air-conditioning and winter heating use the same distributing system. In hundreds of stores, restaurants, offices, etc. these Janitrol installations conserve valuable space and have proved both practical and economical.

Write today

for your A.I.A. File Folder on Commercial & Industrial Heating. It's a practical guide on the selection and installation of unit heaters to meet a wide range of heating requirements.

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

For *complaint-free* low velocity air distribution



THE CARRIER CORPORATION OFFICES, New York City. Multi-Vent panels, barely discernible in beautiful, plaque-type coffered ceiling. Remarkably fine temperature regulation achieved by varying air volume in each zone with thermostat controlled modulating dampers.

Use the Best...

Use **MULTI-VENT** *Ceiling Panels*

T. M. Reg. U. S. Pat. Off.

Though the cost of supply and return air outlets is a very small percentage of the overall cost of a good air conditioning system, economizing in the selection of air distribution media is often the cause of complaints from clients on drafts, uneven temperatures, insufficient air, noise and dirty ceilings.

Multi-Vent is better able than any other diffuser to provide widespread uniform air distribution, without these common objectionable conditions because the basic draft, noise and dirt hazards, inherent in all other diffusers, are non-existent in the unique Multi-Vent principle of *distributing air entirely by displacement rather than by high velocity injection.*

In distribution by displacement there are *no* strong air streams to aim and *no* change in air flow pattern when air supply is varied. Regardless of room size, ceiling heights and relative positions of partitions, beams, etc., *all problems of outlet location and air direction adjustments for throw and drop to avoid drafts are eliminated.*

Multi-Vent, moreover, can handle greater amounts of air in proportion to room size than any other diffuser and still maintain a rate of air motion low enough to meet not only the most exacting comfort zone requirements but also to solve the high load and high ventilating problems in critical laboratory and industrial processing areas.

Multi-Vent has many other advantages such as savings in basic heating, cooling and air handling equipment in addition to the important installation, maintenance and decorating economies.

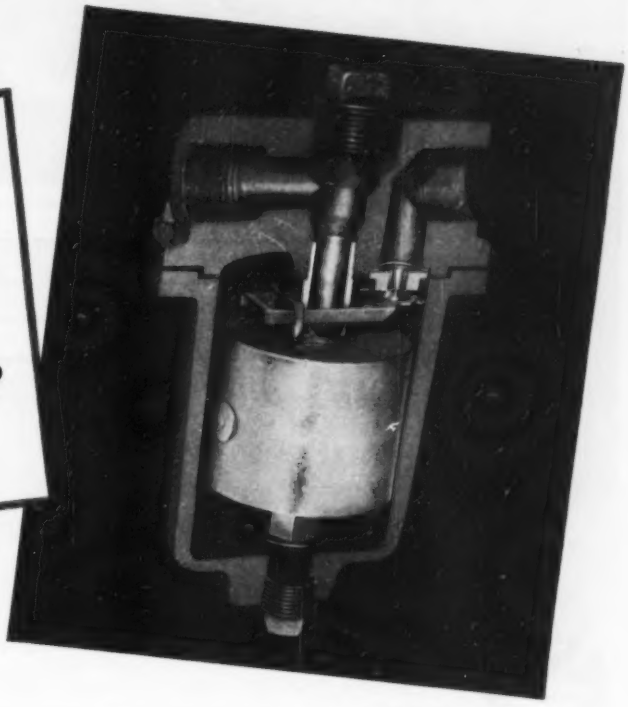
Write for detailed literature and the name of our sales engineer in your vicinity.

MULTI-VENT DIVISION • **THE PYLE-NATIONAL COMPANY** 1373 N. KOSTNER AVE., CHICAGO 51, ILL.

YOUR ENTIRE AIR CONDITIONING SYSTEM WILL BE JUDGED BY THE PERFORMANCE OF THE OUTLETS

The Inside Story

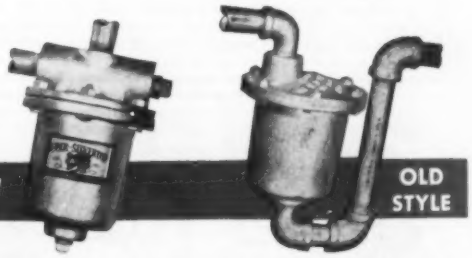
on WHY YOU SAVE with SUPER-SILVERTOP Steam Traps



IN THIS CUTAWAY VIEW of an Anderson Super-Silvertop Steam Trap, you can see that all pipe connections are in the head of the trap. The alternate top inlet connection provides for elbow connection, as well as straight-in-line. This means simplified piping, saving up to nine fittings, plus forty minutes of costly installation time over conventional traps! See how the guided bucket permits the use of a longer lever arm with greater valve opening power. This larger valve means more capacity for the same size trap. Super-Silvertop trapping is efficient trapping . . . *the most economical you can buy.*

You save two ways . . . in installation costs and operating costs. Learn how to cut your steam trapping costs. Write for the helpful book, "Solving Steam Trap Problems."

THE V. D. ANDERSON COMPANY
1949 WEST 96TH STREET • CLEVELAND 2, OHIO



USE SUPER-SILVERTOP IN-LINE OR AS AN ELBOW

OLD STYLE

Save Money With SUPER-SILVERTOPS

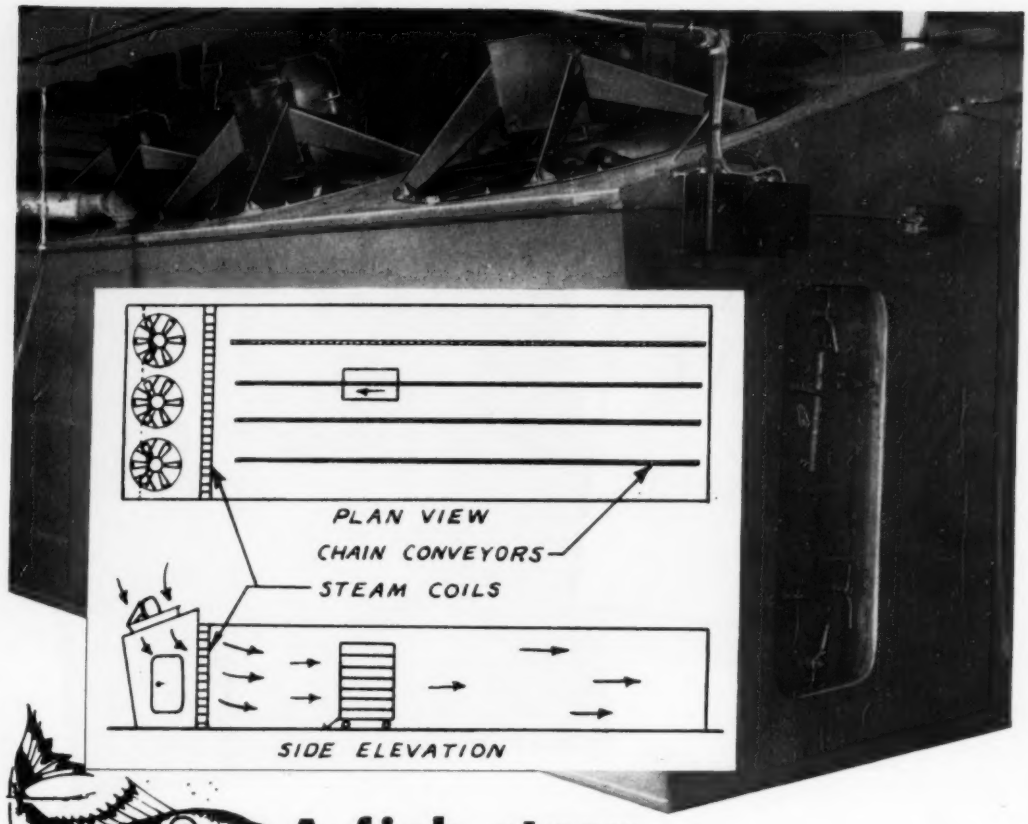
THE V. D. ANDERSON COMPANY
1949 WEST 96TH STREET • CLEVELAND 2, OHIO

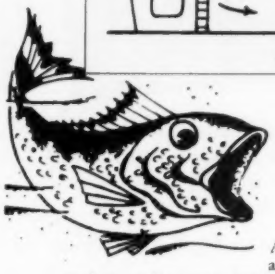
Gentlemen: Please send me a copy of the booklet, "Solving Steam Trap Problems."

Name .....

Address .....

City ..... *State* .....





A fish story you can believe

A trio of Propellair fans made a fish story for a New England sardine packer more intriguing than that of the "big one that got away."

These fans, mounted in a drying tunnel, effectively dry fish at 80° F. by maintaining velocities at 1400 feet per minute. Prior to improvement by Propellair engineers, this process required temperatures as high as 125° because velocity was only 400 feet per minute.

The greater velocity produced by Propellair fans speeds the work, makes drying more even, reduces fuel costs. Since the original installation, this drying method has become a standard in the industry.

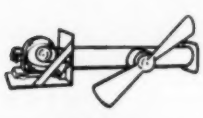
BLADES HAVE AERODYNAMIC DESIGN

The same airfoil principle built into an aircraft wing is engineered into Propellair fan blades. Both sides of the blade, from tip to hub, move air.

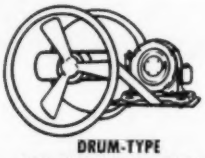
TYPES FOR EVERY PURPOSE

A variety of Propellairs is available—for roofs, stacks, ducts, windows, walls; on pedestals or stand mounts. Sizes to 60", capacities to 85,000 CFM.

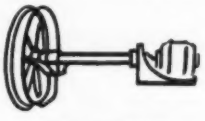
Propellair engineers will survey any job and supply complete ventilation plans without obligation. Or write for complete details on type fans you need.



DRUMLESS,
FOR DUCTS AND STACKS



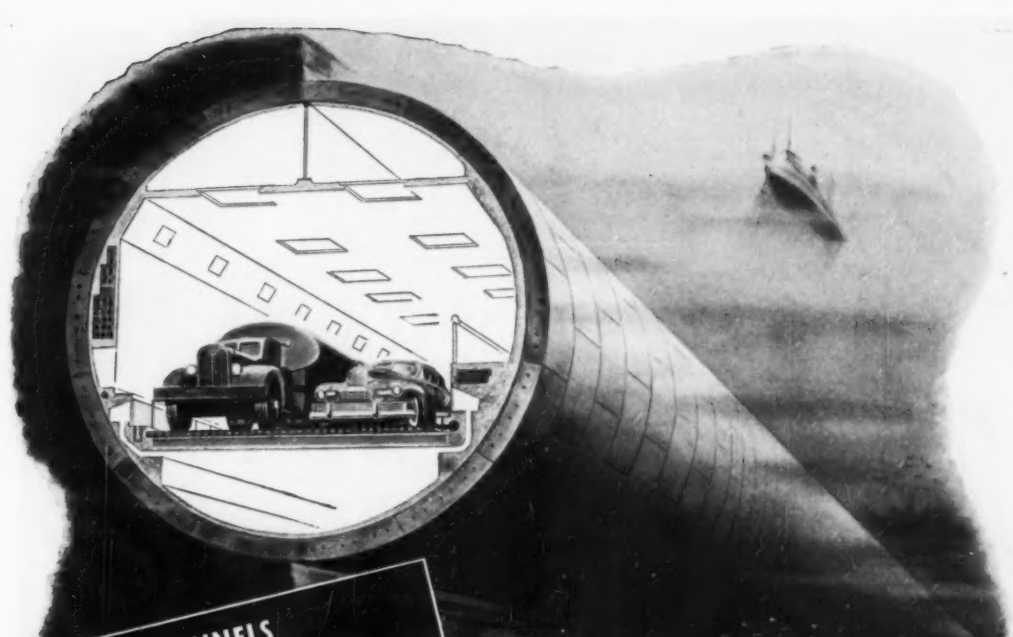
DRUM-TYPE
FOR DUCTS AND STACKS



EXTENDED-SHAFT,
PROTECTS MOTOR

DIRECT-CONNECTED,
MANY USES

PROPELLAIR DIVISION OF ROBBINS & MYERS, INC.
SPRINGFIELD 99, OHIO
"Moving Air is our Business"



TYPICAL SKF VEHICULAR TUNNEL INSTALLATIONS

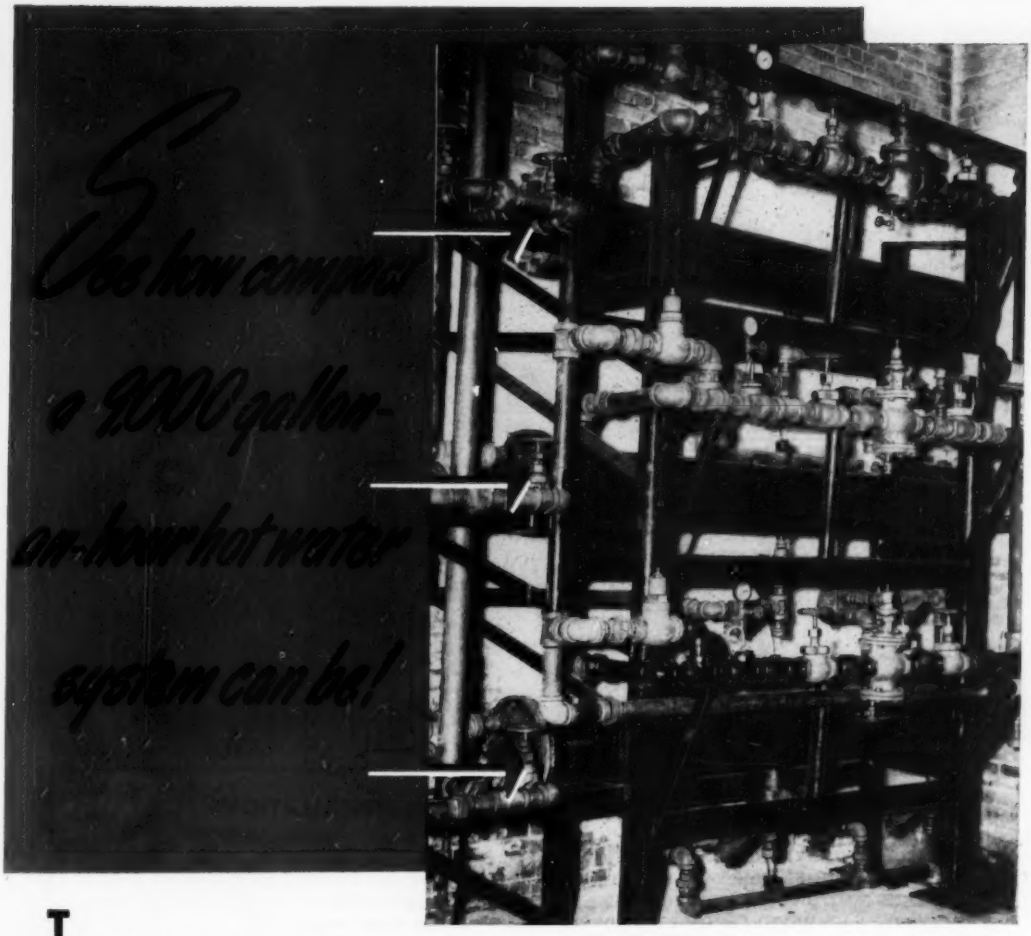
Location	Number of Fans	Fan Manufacturer
LINCOLN TUNNEL, New York—South Tube	36	Buffalo Forge Company
LINCOLN TUNNEL, New York—North Tube	20	Westinghouse Electric Corp.—Sturtevant Division
QUEENS MIDTOWN TUNNEL, New York	46	Westinghouse Electric Corp.—Sturtevant Division
GEORGE WASHINGTON BRIDGE APPROACH TUNNEL, New York	8	Buffalo Forge Company
PENNSYLVANIA TURNPIKE—7 TUNNELS	26	Westinghouse Electric Corp.—Sturtevant Division
BANKHEAD TUNNEL, Mobile, Ala.	3	Clarage Fan Company
BROOKLYN BATTERY TUNNEL, New York	53	Westinghouse Electric Corp.—Sturtevant Division
BROOKLYN BATTERY APPROACH TUNNEL, New York	12	Westinghouse Electric Corp.—Sturtevant Division
WASHBURN TUNNEL, Houston, Texas	5	Westinghouse Electric Corp.—Sturtevant Division

SKF Spherical Roller Bearings have been specified for most of the major tunnel-fan installations because they're self-aligning . . . long-lived . . . require infrequent lubrication and inspection . . . give continuous trouble-free service under highly adverse conditions. SKF *Industries, Inc., Philadelphia 32, Pa., the Pioneers of the Deep Groove Ball Bearing, Spherical Roller Bearing, Self-Aligning Ball Bearing.* 7073

SKF
BALL AND ROLLER BEARINGS

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

INTEGRITY — CRAFTSMANSHIP — METALLURGY — TOLERANCE CONTROL
SURFACE FINISH — PRODUCT UNIFORMITY — ENGINEERING SERVICE — FIELD SERVICE

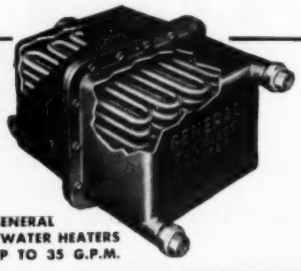


This battery of General Instantaneous Water Heaters (three No. 632's) shows how a leading tannery has modernized its hot water system.

THE INSTALLATION shown above delivers practically all the hot water required by a New England tannery . . . 9,000 gallons an hour, 40° to 180° rise, with steam at 6 lbs. pressure. It consists of three No. 632 General Instantaneous Heaters connected in parallel. Notice how little space it occupies . . . just a small corner of the boiler room.

General Instantaneous Water Heaters are made in 12 sizes to deliver up to 270 gallons of continuous, clean hot water per minute through seamless copper tubing. They're heated with live steam up to 125 lbs. through the shell, or with exhaust steam or boiler water.

If space is at a premium at your plant or you are looking for a way to reduce overhead, investigate this efficient economical system. It's inexpensive to install . . . no tank . . . no excavating . . . no complicated piping. Consider it as a source of supply or as a booster for existing hot water systems. Separate units can be advantageously spotted throughout your plant. Get complete information in Catalog 18. Write General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.



GENERAL
TANKLESS WATER HEATERS
7 SIZES UP TO 35 G.P.M.

GENERAL

TANKLESS AND INDIRECT
WATER HEATERS AND HEATING SPECIALTIES

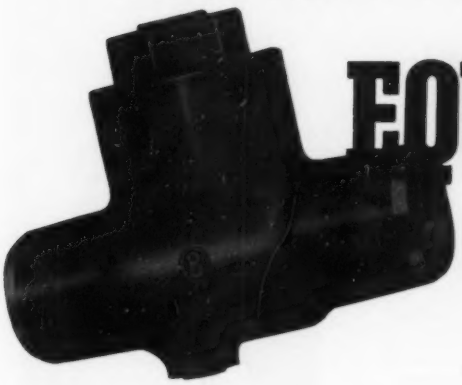
SAVE

Extra globe or gate valve

Extra "T" fitting for venting

Extra "T" fitting for temperature readings

three extra fittings with



EQUA=TEMP

the new "single-package" radiant heat valve

Here at last is a low cost balancing valve that does the whole job. Accurate balancing--leak-tight shutoff--tamperproof control--variable venting--and a convenient integral well for temperature readings--are all provided in this complete, "single-package" valve.

A butterfly-type closure disc permits easy operation, and a synthetic rubber "O" ring fits snugly around the disc, providing absolute shutoff on hot water.

To prevent tampering by the "home-plumber," manual operation of this valve is by Allen type wrenches or handy key provided.

EQUATEMP valves are available with both solder-type pipe ends $\frac{3}{8}$ to $\frac{3}{4}$ inches and screwed-type $\frac{3}{4}$ to $1\frac{1}{2}$ inches.

Contact your local distributor of Ohio Brass valves for further information about EQUATEMP or send in coupon below for fully illustrated folder.

OHIO BRASS COMPANY
MANSFIELD, 3, OHIO

Please send me EQUATEMP folder 862-VR.

Name .....

Company .....

Street .....

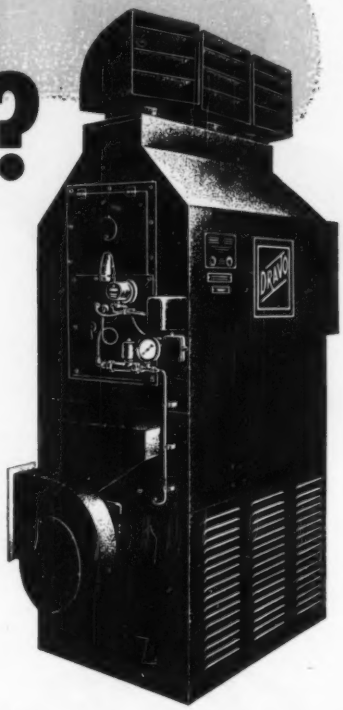
City ..... State .....

4022-V

MOST HEATING SYSTEMS END UP BY

WARMING THE AIR

WHY NOT BEGIN WITH IT?



DRAVO *Counterflo* HEATERS

Dravo *Counterflo* Heaters provide a highly efficient heating method for open area structures. This method is efficient because it heats the air right where it's to be used and without employing water or steam as intermediaries.

No "conversion" losses with Dravo *Counterflo* Heaters on the job. The heater warms the air, and the positive, directed circulation floods the working zone with warmth. Burns oil or gas as fuel—can be readily converted from one to the other. Low fuel cost—80 to 85% efficiency. Low installed cost—users report 50 to 66% less investment than in standard wet type heating systems. Immediate delivery, quick, easy installation, no delays due to pipe shortages. Thousands of successful installations. Write for Bulletin CD-523-354.

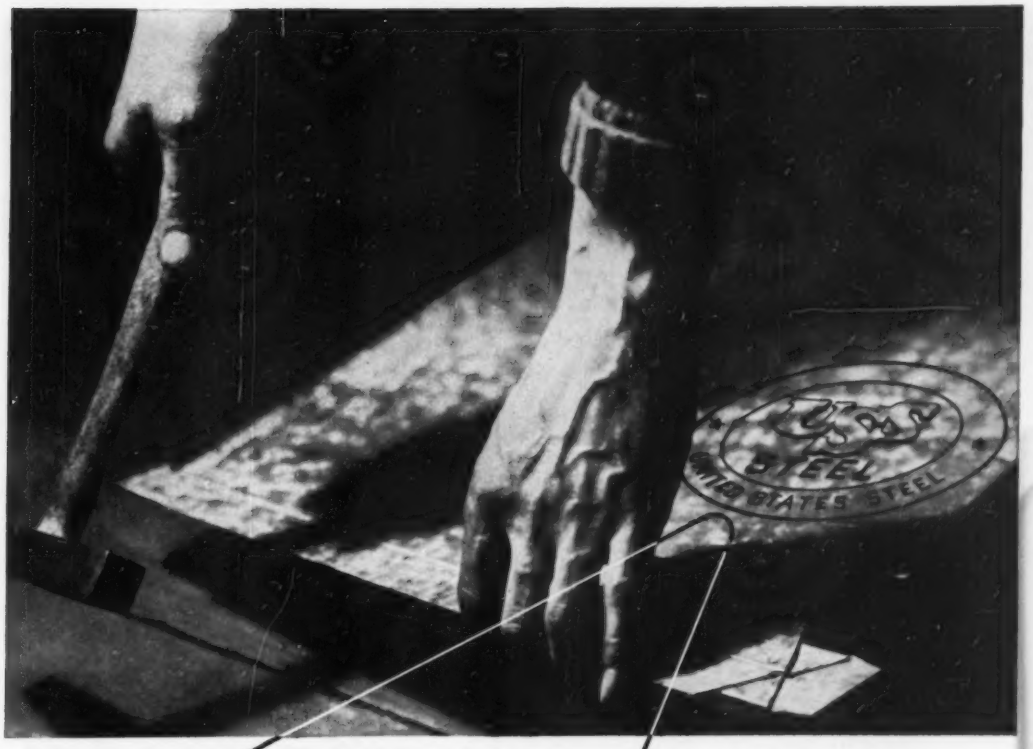
DRAVO
CORPORATION
DRAVO BUILDING, PITTSBURGH 22, PA.

Dravo also manufactures the *DRAVO CRANE CAB COOLER* for air conditioning hot-metal crane cabs.

PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON

Sales Representatives in Principal Cities. Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec.

DRAVO



How's your stock?

Don't get caught short on sheets. Keep enough on hand to handle any size job! It will pay you to ask your jobber for those bearing the familiar U·S·S Trade-mark. It is your guide to the finest quality . . . and your customers' assurance that you are using the best sheets available.

The brand most in demand . . .

● Difficult shapes and angles are easy to make . . . true bend, tight seams and neat joints easy to obtain when you use U·S·S Galvanized Steel Sheets. Highly resistant to rust and corrosion, and uniform in surface, flatness and ductility, they may be bent, rolled, cut, and seamed with ease and accuracy. These superior forming characteristics result in speedier shop practice and better looking, more durable jobs.

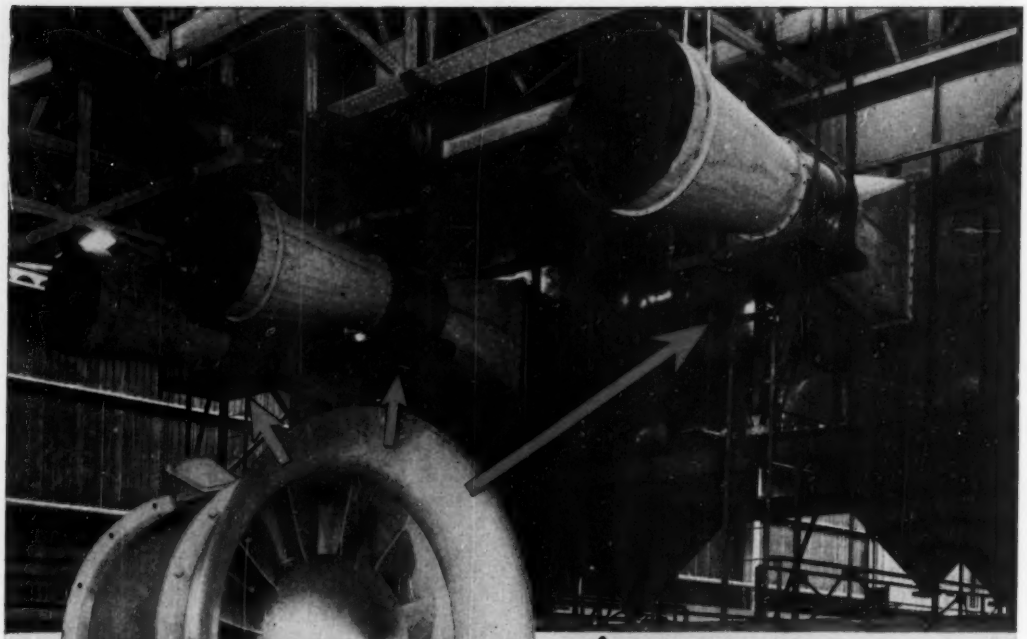
Another reason it will pay you to use U·S·S Galvanized Steel Sheets is that they are the best-known, most widely advertised sheets in the industry. The familiar U·S·S Trade-mark stands for dependable quality. It gives the jobs you turn out greater sales appeal . . . assures greater customer satisfaction.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S STEEL SHEETS

UNITED STATES STEEL



What's your ventilation job?

JOY AXIVANE* FANS

WILL DO IT MORE EFFICIENTLY AND MORE ECONOMICALLY!

Write for Bulletin, or *Consult a Joy Engineer*

From every possible angle, JOY Series 1000 AXIVANE Fans will give you a better, lower-cost job. Their inline, vane-axial design is lighter and more compact; and they operate more quietly, require less power and space, and save greatly on installation time and costs. What's more, you get the extra flexibility of adjustable blades—a standard JOY feature—permitting easy and quick on-the-job regulation of pressure or volume over a wide operating range, with positive protection against motor over-load.

Whatever your job is, JOY AXIVANE Fans can show you advantages—let us work with you.

*Reg. U.S. Pat. Off.

W&D 12356

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

packaged efficiency

PLUS SAFETY

PLUS ECONOMY

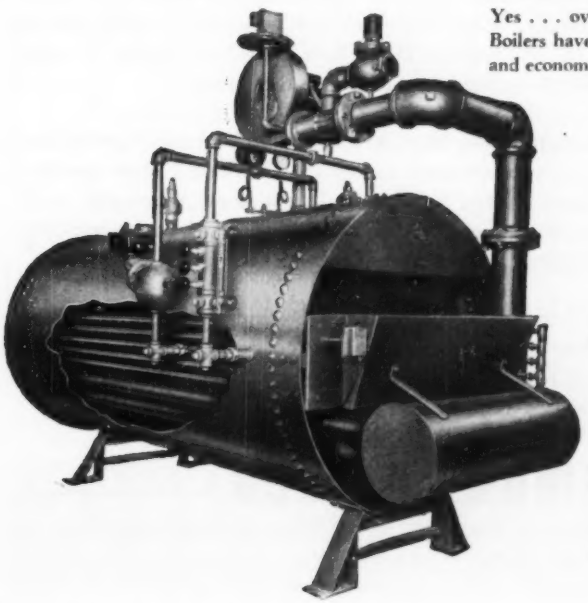
WRITE FOR BULLETIN

There are no extras to bother about when you install a Sellers Immersion Steam Boiler. It's shipped complete with everything you need including blower, controls, trim, and all other accessories. And it's packed so the unit will move easily through narrow doorways.

But . . . unlike the ordinary "packaged" boiler, the Sellers is safe. There's no enclosed combustion chamber . . . no explosion hazard. The Sellers principle of Immersion Firing does not require complete enclosure of the burners.

And, of course, Sellers Immersion Firing provides maximum economy. There's no heat loss. With the firing tubes completely submerged, the heat goes directly into the water . . . nowhere else. Scale doesn't build up. It's constantly cracked off as tubes expand and contract. Furthermore, there's no water line corrosion . . . you get fast steaming and dry steam . . . and you don't need traps or pumps for the return of condensate.

Yes . . . over a period of 20 years, Sellers Immersion Steam Boilers have built a reputation for maximum efficiency, safety and economy. That's why it's good business to specify Sellers.



Write today for our bulletin No. 1206-C. It gives full details.

Sellers

IMMERSION STEAM BOILER

SELLERS ENGINEERING COMPANY
4876 N. Clark St., Chicago 40, Illinois

Blast Heaters—Immersion Automatic Water Heaters—
Air Heaters—Combustion Units—Industrial Gas Burners—
Immersion Tank Heaters—Vertical Steam Boilers—
Gas Combustion Equipment.

James M. Osborne
OF HERMAN NELSON

The groundwork for James M. Osborne's career in the heating and ventilating industry was laid at Lafayette College, where he was a student of engineering. After college, Osborne became a design engineer with the Army Air Forces, and later with Curtiss Aeroplane and Motor Company. When he joined the Herman Nelson organization 11 years ago, his experience already included seven years in solving heating and ventilating problems. Today, he is manager of Herman Nelson's Washington, D. C. Branch Office. The name, James M. Osborne, can be found among members of the American Society of Heating and Ventilating Engineers, the Washington Board of Trade and the Capitol Yacht Club.

WHETHER your heating or ventilating problem calls for unit heaters, unit ventilators, propeller fans or centrifugal fans, you can be certain the Herman Nelson Product Application Engineer nearest you will handle your problem efficiently and economically. More than 75 of these experienced representatives like James M. Osborne of Washington, D. C., have earned the respect of architects, contractors and school authorities throughout the nation.

Herman Nelson Product Application Engineers look upon your customers as their customers. They leave no stone unturned to see that Herman Nelson products are installed properly. These Product Application Engineers are thoroughly qualified to make recommendations, give advice and furnish concise, easy-to-use engineering data and specifications.

More than 200 carefully selected Distributors and Stocking Jobbers supplement the services of Herman Nelson Branch Offices and Product Application Engineers. This group has built up a reputation for service that goes hand in hand with the superiority of Herman Nelson heating and ventilating products.

HERMAN NELSON

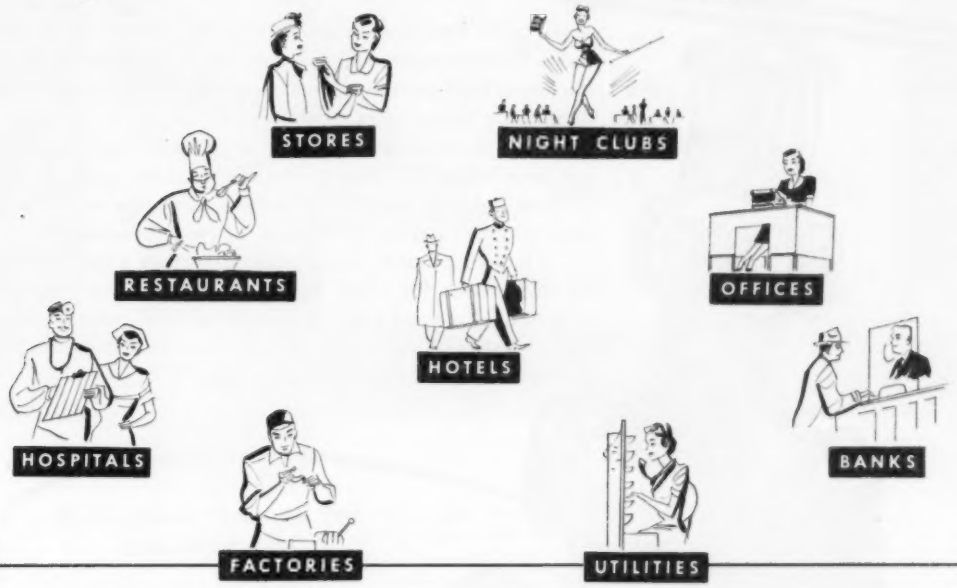
DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

SINCE 1906 MANUFACTURERS OF QUALITY HEATING AND VENTILATING PRODUCTS

DIVISION OFFICE: MOLINE, ILLINOIS

MONEY IN THE TILL

for them . . . for you



Name a business in your community and we can tell you how others exactly like it have profited by electrostatic air cleaning. Clean air pays in so many ways — in more patronage, better service, less spoilage, fewer losses, lower cleaning and redecorating costs. No wonder it is now so widely recognized as a profitable investment.

Electrostatic air cleaning can mean more money in your till, too. There are profit opportunities all around you. Every old customer, every new prospect presents an opportunity to install a Raytheon Precipitator Don't overlook this new and growing source of profitable business. Write for complete information today.

RAYTHEON MANUFACTURING COMPANY

DEPT. 6460-HP, WALTHAM 54, MASSACHUSETTS

RAYTHEON

RAYTHEON PRECIPITATORS

(ELECTROSTATIC AIR CLEANERS)

FOR *Steel Valves* YOU CAN'T GO WRONG ON LUNKENHEIMER

This mark on steel valves is your assurance of highest quality

THE trend toward wider use of steel valves for many services makes Lunkenheimer, who pioneered the development and production of high pressure-high temperature designs, a logical and dependable source of supply.

Here you have top metallurgical research, sound engineering knowledge and design, advanced foundry practice, most modern tools and manufacturing equipment, plus wide experience, to guide you in the selection of your requirements.

The type of valve illustrated is only one of a complete line of steel valves for every industrial purpose. Available in a variety of alloys and trims to suit specific applications . . . gate, globe, angle and check patterns, 150 lb. to 2500 lb. and higher pressures; screw, flange or welding ends.

300 lb. CAST STEEL GATE
Fig. 1938-WD6

Body and bonnet are of Carbon Molybdenum Steel to provide for higher pressure-temperature operation than the limits prescribed for carbon steel. Disc and stem are stainless steel, seat rings high tin content nickel alloy developed by Lunkenheimer—a fine-wearing combination for steam up to 850° F., and general service on water, gas or air.

Lunkenheimer design and construction insure all the essentials for satisfactory and low-cost service.

Helpful Service at Your Call . . .

Lunkenheimer representatives and sales engineers will be glad to work with you on any problem of valve installation and usage. And for your immediate maintenance requirements, call your Lunkenheimer Distributor. He is well qualified to take care of your needs.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 · CHICAGO 6 · BOSTON 10 · PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

Leadership Through Achievement

THE Armstrong hardened chrome steel valve opens wide and closes tight — with a snap! This eliminates throttling and consequent wire drawing. The Armstrong free-floating lever mechanism is almost frictionless. The bucket and valve lever assembly are 18-8 corrosion resistant stainless steel. The mechanisms of Armstrong steam traps for low and medium pressures are identical in materials and workmanship to those used in Armstrong traps for pressures to 1500 psi, 900 F.

There is nothing in an Armstrong trap to bind, stick, collapse or leak. *Now is the time to quit working for your steam traps and buy the traps that will work for you.* Call your nearby Armstrong representative today.

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Mich.

50% SAVINGS IN MAINTENANCE since installing Armstrong steam traps on the heating system at *John Deere Ottumwa Works, Ottumwa, Iowa.* This is typical of reports from Armstrong users.

THE 36-PAGE ARMSTRONG STEAM TRAP BOOK contains complete data on the design, operation, selection and installation of Armstrong steam traps for all services. Send for your free copy.

ARMSTRONG STEAM TRAPS

IT'S A CRIME!

TO THROW AWAY 30% OF THE PRICE OF AIR FILTERS!

Glasfloss

RE-FILL TYPE AIR FILTERS END THIS COSTLY WASTE

Thirty percent of the cost of most air filters is in the frames that are thrown away. Glasfloss now offers a glass fibre air filter in a light-weight metal reusable frame that saves 30% on replacement purchases.

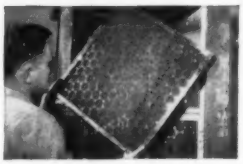
When the Glasfloss pad has accepted its full load of dirt, open the frame, discard the pad and insert a new one.

EXTRA FINE FIBRES

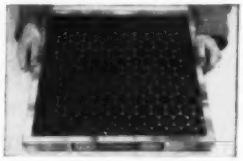
Glasfloss Air Filters are made of long, extra fine fibres that form a fluffy mass with millions of air passages. That's why they stop more dirt while permitting free movement of air. The silky fineness of Glasfloss fibres permits them to be handled without injury or discomfort.

FIGURE IT OUT—

Any large filter installation, whether for Warm Air Heating, Ventilating or Air Conditioning, offers interesting savings when equipped with the Glasfloss Re-fill Type Air Filters. Each replacement costs 30% less than replacement with disposable filters. Write for full information.



When Glasfloss pad is full, just remove it from the lightweight re-usable metal frame.



Insert a new pad and replace—at a saving of 30% over disposable filters.

Glasfloss Air Filters—Re-fill Type—They STOP DIRT NOT AIR.

Glasfloss

155 E. 44th Street, New York 17, N. Y.

A CURTIS Franchise is MONEY IN THE BANK

BECAUSE CURTIS EQUIPMENT

SELLS and STAYS SOLD

AND YOU CAN HANDLE ANY...

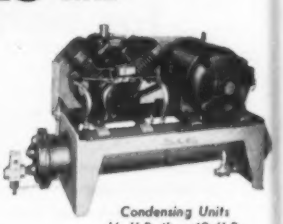
AIR CONDITIONING • REFRIGERATION • or AIR MOVING JOB

WITH THE COMPLETE CURTIS LINE

With the addition of new 2, 3 and 8-ton package type and 30 and 40-ton remote type air conditioners to the comprehensive Curtis line, the Curtis dealer is in his best position in history. Long known for their performance record, Curtis Packaged Air Conditioners are built to operate efficiently with minimum installation and maintenance costs.

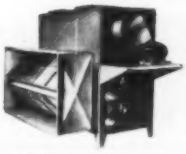
Supported with big, colorful full page advertisements in the Saturday Evening Post, Time, Newsweek and many other consumer magazines, plus an assortment of powerful sales promotion helps, the Curtis dealer will find Curtis equipment is recognized and wanted by consumers everywhere.

Packaged Type 2½ to 8 tons



Condensing Units ¼ H.P. thru 40 H.P.

Central Type 10 and 15 tons



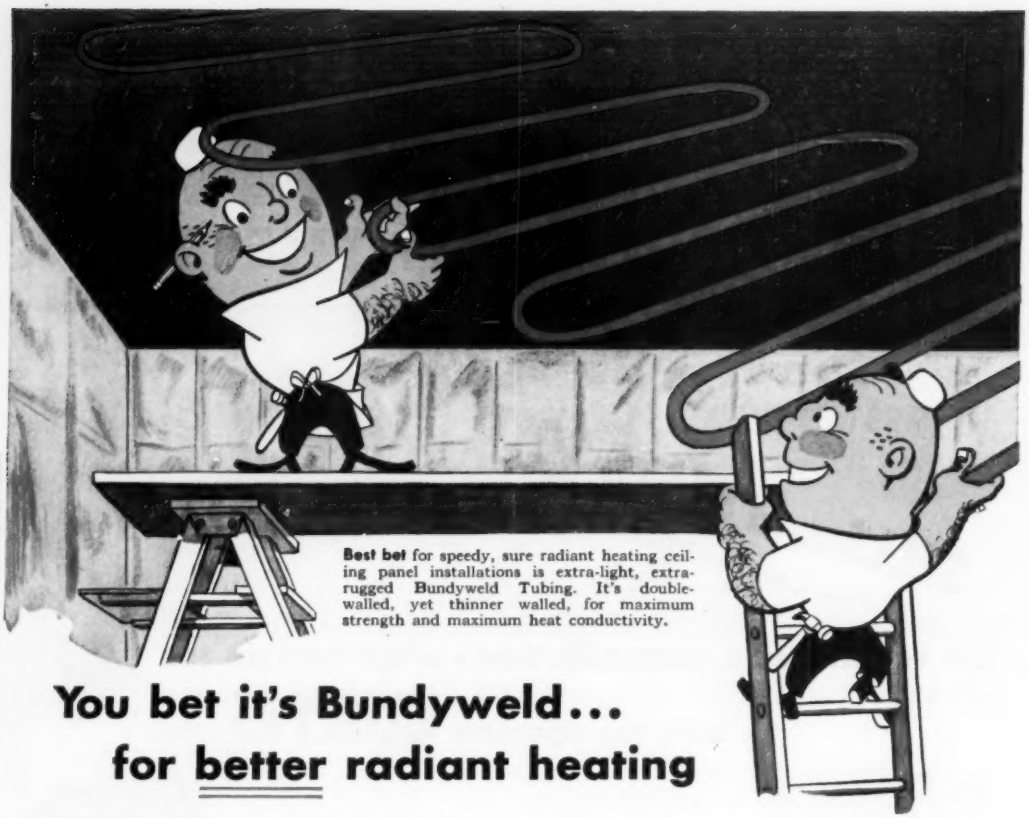
Ceiling and Floor Type Air Handling Units

Evaporative Condensers, and Cooling Towers to Match

CURTIS Refrigerating Machine Division
of Curtis Manufacturing Company
1950 Kienlen Avenue, St. Louis 20, Mo.

96 YEARS of SUCCESSFUL MANUFACTURING

R50-2



Best bet for speedy, sure radiant heating ceiling panel installations is extra-light, extra-rugged Bundyweld Tubing. It's double-walled, yet thinner walled, for maximum strength and maximum heat conductivity.

You bet it's Bundyweld... for better radiant heating

Your best bet for better radiant heating panel installations is amazing Bundyweld Tubing.

And here's why—*no other tubing can match all the advantages Bundyweld offers, for no other tubing is made like Bundyweld!*

It's double-walled from a single strip, a patented construction that gives it the sturdiness to withstand the jars and jolts on the job. It's thinner walled, too, for maximum heat conductivity. It's lightweight, ductile, easy to shape and a cinch to solder or braze. Right from its arrival on the building site, you get major savings in labor and costs all down the line with dependable Bundyweld.

There's more, too

With a coefficient of thermal expansion very close to that of average plaster mix, Bundyweld can be installed without plaster worries. Painting offers no headaches, either, when normal precautions are exercised in installation.

Check on Bundyweld Tubing now . . . your best bet for better radiant heating installations. Write: ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

SIZES UP TO 5/8" O.D.

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

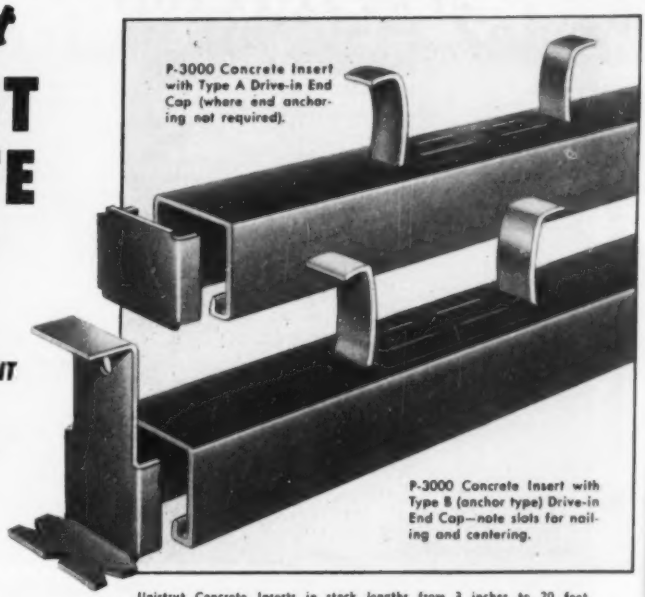
Bundyweld . . . double-walled and brazed through 360° of wall contact.

Announcing an Entirely New, Improved, Lower Cost

UNISTRUT CONCRETE INSERT

WITH A CONTINUOUS SLOT THAT PERMITS ATTACHMENT ANYWHERE ALONG ENTIRE CHANNEL

WITH POSITIVE CLAMPING ACTION PROVIDED BY THE SLIDING EASILY-INSERTED UNISTRUT SPRING NUT



P-3000 Concrete Insert with Type A Drive-in End Cap (where end anchoring not required).

P-3000 Concrete Insert with Type B (anchor type) Drive-in End Cap—note slots for nailing and centering.

Unistrut Concrete Inserts in stock lengths from 3 inches to 20 feet. Channel is 1⅝" wide by 1⅜" high outside dimensions, of 12-gauge cold rolled steel. Load capacity 2000 lbs. per foot with a safety factor of 3.

A CHALLENGE—We believe this to be the greatest development in concrete insert design and manufacture since concrete inserts were first introduced . . . with advantages that are obtainable only and exclusively with Unistrut. Attachments are easily and quickly made by inserting Unistrut spring nut when and where you wish without disturbing other attachments. Bolting of fitting secures the nut tight to "double track" formed by inturned edges of channel, provides positive clamping action, prevents slippage. Standard lengths up to 20 feet make these the longest concrete inserts ever offered!

CONCRETE INSERTS PART OF UNISTRUT FRAMING SYSTEM

The concrete inserts shown in this folder are part of Unistrut—a completely adjustable metal framing system that provides a new and more flexible type of mechanical support for every kind of piping, conduit, cable, and for every conceivable kind of equipment used in industry today. Unistrut is metal channel with a continuous slot. You simply insert the Unistrut spring nut into the channel at approximate point where attachment of another framing member is desired, slide to exact location and bolt to Unistrut fitting. Unistrut includes concrete inserts, roller pipe supports, brackets, clamps, hangers and many other standard parts which in combination provide the world's most flexible system of support or suspension. Unistrut does the complete job—you need no other parts or materials. No drilling, no welding—100% adjustable and reusable.

Write for your Free Sample of Unistrut and new Concrete Insert Bulletin today!

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill., Dept. H3

Please send free sample of Unistrut and Bulletin CI-2.
Bulletin CI-2 ☐ Unistrut Sample ☐

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U. S. Patent Numbers
2327587 2380379
2363382 2345650
2329815 2405631
Other patents pending

UNISTRUT
The World's Most Flexible All-Purpose Metal Framing

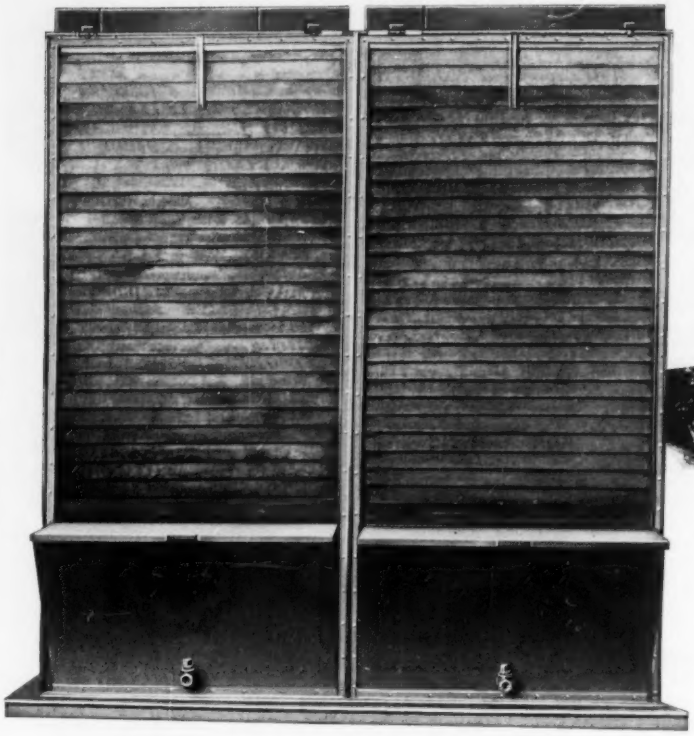
THE 3 QUICK UNISTRUT STEPS

1. Insert Nut into Channel
2. Locate Fitting and Nut
3. Tighten Bolt —it's done

Prompt Delivery from Warehouse Stocks in Principal Cities, Consult your Telephone Directories

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd. • Chicago 7, Illinois

LONG LIFE AND DEPENDABLE SERVICE AT NO EXTRA COST



17 YEAR OLD AAF FILTER at Louisiana Capitol still performing satisfactorily

ONLY time can determine a product's true cost. Millions of cubic feet of air have been cleaned by this AAF Multi-Duty filter, yet its efficiency is at the same high level after 17 years of service at Louisiana's State Capitol.

Air filters, with proper maintenance, are a long time investment. AAF products are designed as such. Every unit is carefully engineered with the future in mind. Quality materials and exacting workmanship are evident in every detail. Finally, a capable sales-service field organization makes certain that you get the right filter for your requirements, supervises its installation and periodically checks its performance.

Advanced engineering, quality construction, and above all, "know how"—these are the factors that make for long, low cost filter life. And these are the factors that have made American Air Filter the largest exclusive manufacturer of such products. When you specify AAF you get service—for years to come.

AMERICAN AIR FILTER COMPANY, INC.
373 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF

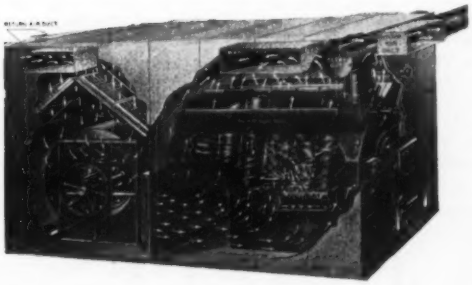
AIR FILTERS
AND ELECTRONIC PRECIPITATORS

A Difficult Heating Problem Solved

Christian Church, Eureka, Ill.; Herbert A. Brand, Chicago, Architect. Successfully heated with a single Campbell unit since 1934.

with a Campbell 8000 Warm Air Heater

Warm air heating for large, multiple-room structures is both practical and economical when you build your plans around a Campbell 8000 Warm Air Heater. Campbell gives you all the advantages of warm air heating; quick heat delivery, positive temperature control, ventilation, and easy adaptability for summer air conditioning. Easy to install—built to give many years of service. Write for complete information.



FOR DRYING & PROCESSING OPERATIONS, WE ALSO BUILD DIRECT OIL AND GAS-FIRED HEATERS UP TO 14,000,000 B.T.U.'s.

Campbell
HEATING COMPANY
3140 Dean Avenue - Des Moines 17, Iowa

Every Campbell Heater Backed by 65 Years Heating Experience

JENKINS PRACTICAL PIPING LAYOUTS 48

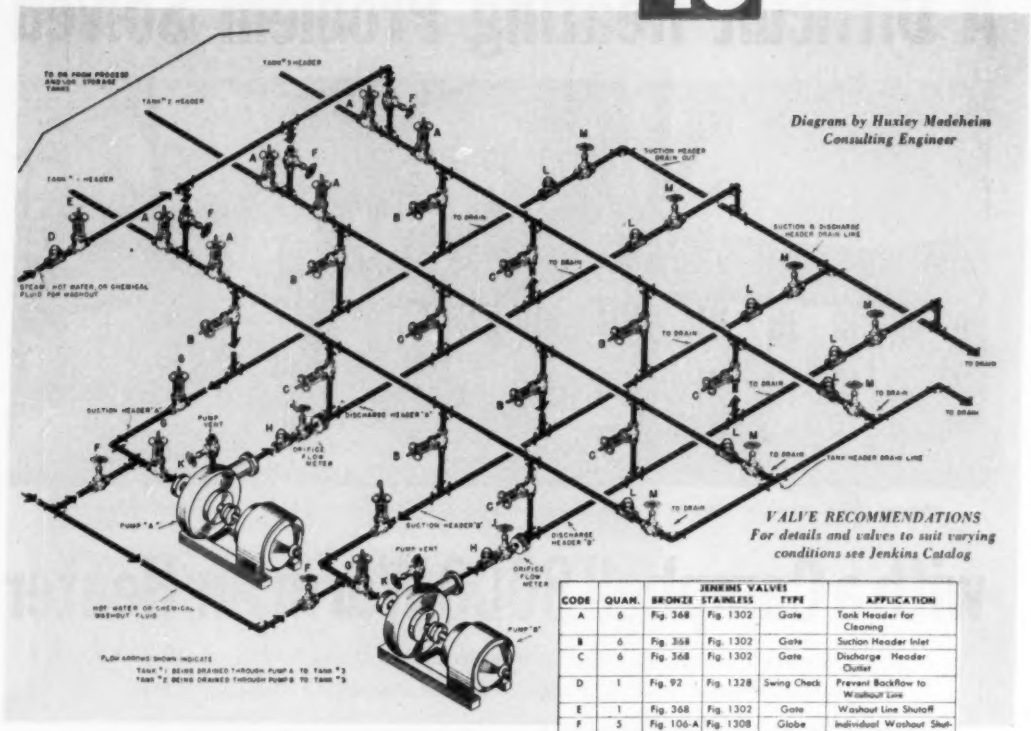

TO OR FROM PROCESS AND/OR STORAGE TANKS
TANK "3" HEADER
TANK "2" HEADER
TANK "1" HEADER
SUCTION HEADER DRAIN OUT
SUCTION & DISCHARGE HEADER DRAIN LINE
TO DRAIN
STEAM, HOT WATER, OR CHEMICAL FLUID FOR WASHOUT
SUCTION HEADER "A"
DISCHARGE HEADER "A"
PUMP VENT
ORIFICE FLOW METER
PUMP "A"
SUCTION HEADER "B"
DISCHARGE HEADER "B"
PUMP VENT
ORIFICE FLOW METER
PUMP "B"
HOT WATER OR CHEMICAL WASHOUT FLUID
TANK HEADER DRAIN LINE
FLOW ARROWS SHOWN INDICATE
TANK "1" BEING DRAINED THROUGH PUMP A TO TANK "3
TANK "2" BEING DRAINED THROUGH PUMP B TO TANK "3

Diagram by Huxley Madeheim Consulting Engineer

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

CODE	QUAN.	JENKINS VALVES BRONZE	JENKINS VALVES STAINLESS	TYPE	APPLICATION
A	6	Fig. 368	Fig. 1302	Gate	Tank Header for Cleaning
B	6	Fig. 368	Fig. 1302	Gate	Suction Header Inlet
C	6	Fig. 368	Fig. 1302	Gate	Discharge Header Outlet
D	1	Fig. 92	Fig. 1328	Swing Check	Prevent Backflow to Washout Line
E	1	Fig. 368	Fig. 1302	Gate	Washout Line Shutoff
F	5	Fig. 106-A	Fig. 1308	Globe	Individual Washout Shut-offs to Tank Headers
G	4	Fig. 368	Fig. 1302	Gate	Pump Suction Shutoffs
H	2	Fig. 92	Fig. 1328	Swing Check	Prevent Backflow to Pump
J	2	Fig. 106-A	Fig. 1308	Globe	Pump Discharge Control
K	2	Fig. 106-A	Fig. 1308	Globe	Pump Vent Control
L	7	Fig. 92	Fig. 1328	Swing Check	

CENTRAL PUMPING STATION FOR TRANSFER OF FLUIDS

In many industries transfer of fluids within a plant is a major operation. The flexible Pumping Station layout shown allows fluids to be pumped from tank to tank or to any processing equipment.

A single pipe line from each tank or piece of equipment is run to the pumping station and there connected to the suction and discharge headers of each pump. Adequate provision must be made for washing pumps, valves and pipe lines, since pollution of one fluid by the remains of a fluid previously pumped is often harmful.

This may be done by means of steam, hot water or chemical solutions, depending upon the fluids carried. Check valves should be installed on drain lines to prevent destructive backflow into the headers. The valve recommended for this layout is the Fig. 106-A, Jenkins Renewable Composition Disc, Bronze Globe Valve, which assures drop-tight closure.

Consultation with accredited piping engineers and contractors is further recommended when planning any major piping installation.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White St., New York 13.
Jenkins Bros., Ltd., Montreal.

Reserve your copy of NEW BOOK OF PIPING LAYOUTS Nos. 26 to 50

A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50—including above, is in preparation. Mail coupon to get your copy when ready.

JENKINS BROS., 80 White Street, New York 13, N.Y.
Reserve copy of New Piping Layout Book for

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JENKINS
LOOK FOR THE DIAMOND MARK
VALVES SINCE 1864
TRADE JENKINS MARK

Jenkins Bros

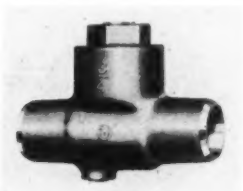
EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1950 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

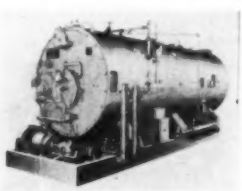
HPAC 4288—BALANCING VALVE—"Equatemp," a bronze balancing valve for hot water radiant heating systems, has been introduced by Ohio Brass Co., Mansfield, Ohio. It is designed to provide both positive shut-off and adjustable flow in a single valve.

The closing and balancing actions are accomplished by a butterfly type disc which is fitted with a composition rubber "O" ring and which is said to assure a leak-tight shutoff for bleeding or venting of lines. The straight through design of the oversize port, says the company, permits optimum flow through the valve and eliminates turbulence. This valve is designed to accommodate any one of several standard venting attachments. In addition, a well is drilled into the stem, thus providing a method for taking temperature readings. All adjustments are made with Allen wrenches or a key which is provided.

Units are available with solder type ends (shown here) in sizes ⅜ to ¾ in. or with screwed ends in sizes ¾ to 1½ in.



Balancing Valve



Steam Generator

HPAC 4289—PACKAGED STEAM GENERATOR—Ames Iron Works, Oswego, N. Y., has added a 500 hp "Amesteam" generator to its line of automatic, packaged type units. Available for pressures from 15 to 200 psi, it may be fired with an oil or gas burner or may be equipped with an oil-gas combination burner.

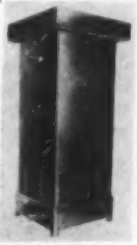
The unit is furnished complete, ready for installation on the boiler room floor. When connected to steam, water, fuel, electric lines, and to breeching or stack, it is ready for operation. The only foundation required, according to the company, is a level floor of sufficient strength to carry the load. Features are said to include a furnace and tube arrangement which provides a high rate of heat transfer, low exit gas temperatures, and rapid water circulation.

HPAC 4290—REFRIGERATION COMPRESSOR—A new line of high speed refrigeration compressors for ammonia application has been developed by York Corp., York, Pa.

Termed V/W compressors because of the cylinder arrangement, the new units are said to provide unusual freedom from vibration and to have almost indefinite life, because cylinder liners and all other parts subjected to wear can be readily removed for replacement. Most of the parts on the various size compressors are interchangeable and upper floor mounting without special foundations is made possible by "complete static and dynamic balance of the compressors." Features include ring plate type suction and discharge valves, spacious gas ports and gas passages, automatic unloading of cylinders when starting, and the use of capacity reducers.

The compressors are available for use with remote condensing equipment (either water cooled or evaporator cooled condensers) to meet refrigeration needs in the range of 15 to 275 hp.

HPAC 4291*—COOLING TOWER—A new cooling tower designed especially for self contained air conditioning units, but applicable to any installation with a water cooled compressor is offered by Carrier Corp., Syracuse N. Y.



Available in four models, ranging from 5 to 15 tons of refrigeration capacity, the new unit is said to permit the recirculation of water with a minimum of loss and this due mainly to normal evaporation. Featuring a water turbine drive, the cooling tower requires only one electrical connection for a small pump which is apart from the tower itself. There are no wearing parts and the fill material, over which the water sprays, is of waterproof asphalt impregnated board.

The four models are for 5, 7½, 10 and 15 hp air conditioning systems. Installation, says the company, is relatively simple, requiring a minimum of piping connections.

HPAC 4292—CENTRAL STATION CONDITIONERS**—New central station air conditioning units in capacities from 7000 to 20,000 cfm are offered by Buensod-Stacey, Inc., 60 E. 42nd St., New York 17.

Low in height, units may be mounted on the floor or suspended from the ceiling. They contain all of the com-

FOR YOUR CONVENIENCE [3-50]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

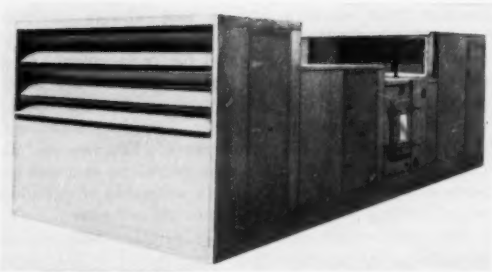
4288	4289	4290	4291	4292	4293	4294	4295	4296	4297
4298	4299	4300	4301	4302	4303	4304	4305	4306	4307
4308	4309	4310	4311	4312					
7564	7565	7566	7567	7568	7569	7570	7571	7572	7573
7574	7575	7576	7577	7578	7580	7581	7582	7583	7584
7585	7586	7587	7588	7589	7590	7591	7592	7593	7594
7595	7596	7597	7598	7599	7600	7601			

Name..... Title.....

Company .....

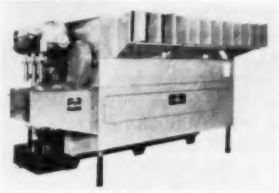
Address .....

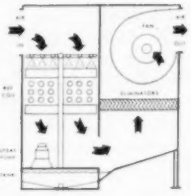
City..... Zone..... State.....



ponent parts of a factory assembled unit, including fan, cooling coil, heating coil, humidifying sprays, and filters, together with outdoor, return, and bypass dampers. Space is also provided so that when desired electrostatic precipitators may be included. Units are factory insulated.

HPAC 4293—SPRAY FAN COOLER—Niagara Blower Co., 405 Lexington Ave., New York 17, has introduced a new series of spray fan coolers recommended for installation in refrigerated rooms where high capacity is required but ceiling height is restricted.





In the new "low head room" design the fan section is located on the side of the unit. The air enters the spray section at the top, is chilled in passing down through the spray and over the refrigerant coils, and enters the fan section at the bottom; being discharged from the side at the top. For refrigerant temperatures below freezing, brine or the company's "No Frost" liquid is used in the sprays.

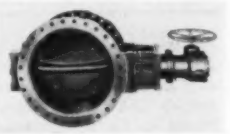
Five unit sizes are produced at present, with capacities ranging from 1680 to 11,000 cfm of chilled air. The maximum height is 72 in. Floor space required ranges from 16 to 72 sq ft.

HPAC 4294—PACKAGED AIR CONDITIONER—New packaged air conditioning units of Brunner Mfg. Co., Utica 1, N. Y., include 3, 5, 7½, and 10 hp sizes.

Features stressed by the company are the use of a relatively slow speed condensing unit to minimize wear and provide long life, an all-copper counterflow condenser independent of the receiver and arranged to assist in cooling the compressor compartment, nonferrous finned cooling coils of six row depth, all-aluminum expanded foil air filters, an outside air connection, and the use of two aluminum drain pans.

The blower assembly is a separate unit mounted above the cooling coil. Each blower is connected to its own motor, and the 7½ and 10 hp units have two blowers.

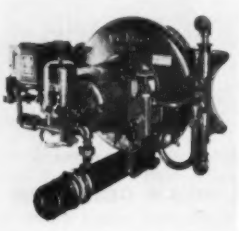
HPAC 4295—VALVES FOR HYDRAULIC SERVICE—The 50 lb line of iron valves available from R-S Products Corp., Wayne Junction, Philadelphia 44, is designed for hydraulic service. These butterfly type valves are offered in sizes from 16 to 72 in.



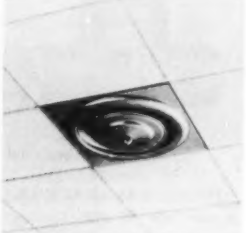
The 30 in. No. 709 class B, cast iron valve shown here is fitted with a rubber seat which is used as a liner against which the valve disc or vane closes. A special composition of rubber and other materials is said to assure retention of resilience and excellent wearing qualities. The valve is said to be air bubble tight at 80 psi and drip tight with water at 100 psi. The handwheel control incorporates a gear reduction drive.

HPAC 4296—INDUSTRIAL OIL BURNER—To handle a more viscous type of No. 5 fuel oil that is becoming increasingly available, Petroleum Heat & Power Co., Stamford, Conn., has introduced the "Petro" model W-A-E oil burner. It is designed to handle a No. 5 oil having a viscosity ranging from 300 sec Saybolt Universal at 100 F up to 40 sec Saybolt Furol at 122 F.

Identical in every respect with the company's model W burner for cold No. 5 oil, the new unit has a thermostatically controlled electric heater, or tempering element, which is factory mounted. It is available in belt driven or built-in motor types to meet all electrical characteristics for capacities up to 100 gph of fuel oil; full automatic, semi-automatic or manual operation; fixed, compound or modulated firing.



Industrial Oil Burner



Air Diffuser

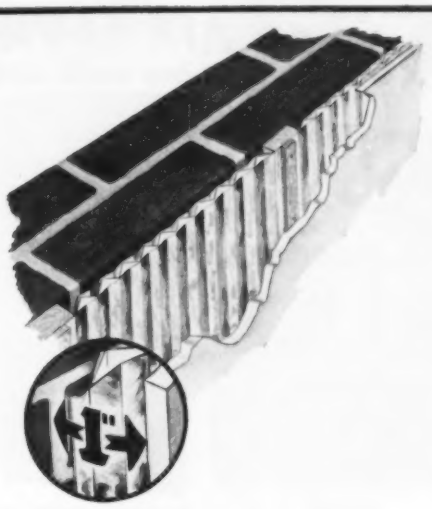
HPAC 4297—CEILING AIR DIFFUSER—Joined integrally with a square panel of lightweight metal, an adaptation of the "Kno-Draft" adjustable air diffuser has been designed for use with all standard acoustical type and rectangular ceiling units. The lines of the panel and the simple design and flat silhouette of the diffuser make it blend unobtrusively with these ceilings, according to the manufacturer, W. B. Connor Engineering Corp., 116 E. 32nd St., New York 16.

The diffuser retains all of its standard features such as adjustability for angle of air discharge, air volume control, etc.

HPAC 4298—SHADED POLE MOTORS—The new line of four pole, shaded pole induction motors of Russell Electric Co., Div. of Raytheon Mfg. Co., 4501 S. Western Blvd., Chicago 9, includes three styles of frames.

THAT BRICK, CONCRETE, OR BLOCK WALL—

Give 1" Space 2" DRY Insulation Value!



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**In new construction between furring strips.*

Use 2 Aluminum sheets ½" apart...

Permanently separated, with 4 reflective surfaces, and 4 reflective accordion spaces; they have zero permeability, are non-condensation forming, non-moisture retaining, will force out fortuitous vapor.

Invaluable under cement floors or floor radiant heating panels—1" space is so economically created. R factor for Down-Heat Flow is 10.30, equal to 3⅔" dry rockwool. A must for shallow spaces around air ducts and for pre-fabricated buildings, trucks, trailers, railroad cars, ships and planes. Heat flow through air spaces in walls is 65% to 80% radiation. Two such aluminum sheets absorb only 3% of heat rays, and radiate only 3%. They are impenetrable by convection; conduction is insignificant. This construction is technically called Type 4 Jr. Infra.

INFRA INSULATION TYPE 4 JR.
Thermal Factors in 1" Space

Down Heat C.097, R10.30, equals 3⅔" Dry Rockwool
Wall Heat C.150, R 6.66 equals 2⅔" Dry Rockwool
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***Vapor Permeability Equals* ZERO**

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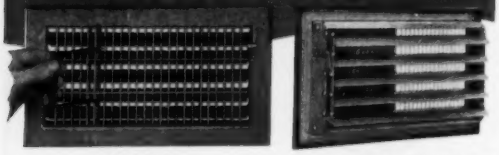
☐ Send Price Lists of Insulations ☐ Send Free Sample

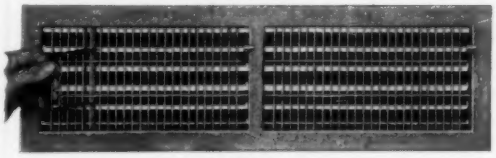
You can get
DIRECTED AIR FLOW at any angle with

INDEPENDENT "Fabrikated" AIR CONDITIONING REGISTERS



321-A HMV — Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4″ to 48 x 24″, including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog No. 48.

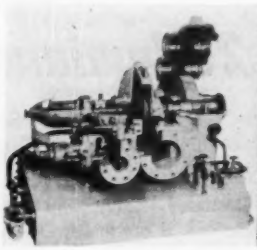
Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

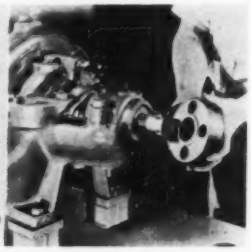
Offered in ratings from 1/10 to 1/60 hp at 1550 rpm, 60 cycles, motors have drawn steel housings with self aligning bearings for general purpose applications. A die cast housing is offered with ball bearings or sleeve bearings, and the third frame style is of unit bearing construction, totally enclosed with sealed lubrication.

HPAC 4299—TURBINE REDUCTION GEAR UNIT—Type E industrial steam turbines with close coupled, integral reduction gears for low speed applications are available from Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30. Equipment such as pumps, fans, compressors, and generators can be driven at their proper speeds by these units while the turbines operate at their most efficient speed.

Three machined feet form a firm three-point support for the unit. Single helical gears with low helix angle are designed to give low thrust against bearings. Endwise movement of one shaft, says the manufacturer, does not affect axial location of the other and thrust is not transferred from the gears to the turbine.



Turbine with Reduction Gear



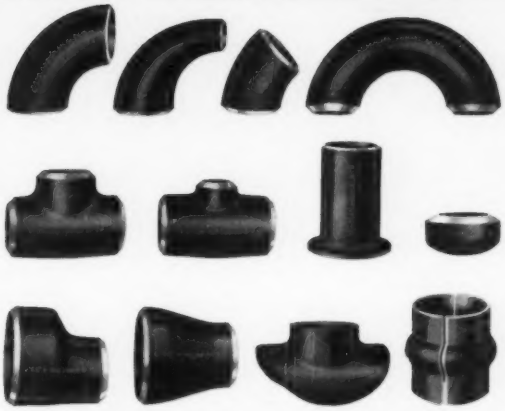
Shaft Coupling

HPAC 4300—SHAFT COUPLING—A new "Magic-Grip" coupling, said to be simply constructed and easy to install or remove from the shafts of pumps or motors, has been announced by Allis-Chalmers Mfg. Co., Milwaukee. Interchangeable with the old standard coupling, the new one, for the present, is available in two bore sizes, 5/8 and 2 1/8 in., both taking up to 120 hp at 3550 rpm. Other sizes will be added later.

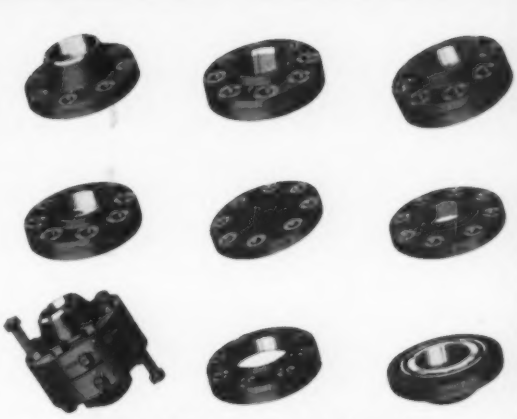
The coupling consists primarily of two cast iron discs with tapered bores, rubber covered tubes assembled on studs, split tapered bushings, and two set screws for each disc.

Four drilled recesses in the bushing accommodate the "off" and "on" positions of the set screw driving holes of the coupling. The holes in the bushing are offset so that when set screws contact them a force is applied in a direction either to drive the tapers of the two pieces tighter or looser, depending upon whether the coupling is being taken off or being put on.

To install, the bushing is placed on the pump or motor shaft. Since it is split part way, it slides. The coupling is then placed over the bushing and the two set screws inserted into the "on" position holes. By means of a wrench, the screws are alternately tightened until they engage the recesses in the bushing. A key between the bushing and the coupling for driving the combination and lining up the correct "off" and "on" positions of both coupling and bushing is designed to make mistaken placement impossible.



SEAMLESS WELDING FITTINGS
½-inch through 36 inches
Standard through Double Extra Strong



FORGED STEEL FLANGES
½-inch through 30 inches
150 lbs. through 2500 lbs. pressure

TO MARK PROGRESS

FORGED STEEL FITTINGS
Screwed and Socket Welding
⅛-inch through 4 inches
2000 lbs. through 6000 lbs. pressure

LONG WELDING NECKS
1-inch through 24 inches

LARGE O.D. FLANGES
26 inches through 96 inches

Ladish...one place to get them all

Available in
CARBON
ALLOY
STAINLESS STEELS
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and OTHER
NON-FERROUS
METALS

Whatever the piping job . . . Ladish is prepared to supply your fittings needs. Here is the one line that offers them all . . . Seamless Welding Fittings, Forged Steel Flanges, Forged Steel Fittings, Large O. D. Flanges and Long Welding Necks . . . in an unrestricted selection of types, sizes, weights, pressure ratings and materials. Standardizing on this complete line not only simplifies procurement but also assures you of added dependability by protecting every joint of the system through use of Ladish Controlled Quality Fittings.

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CUDAHY, WISCONSIN
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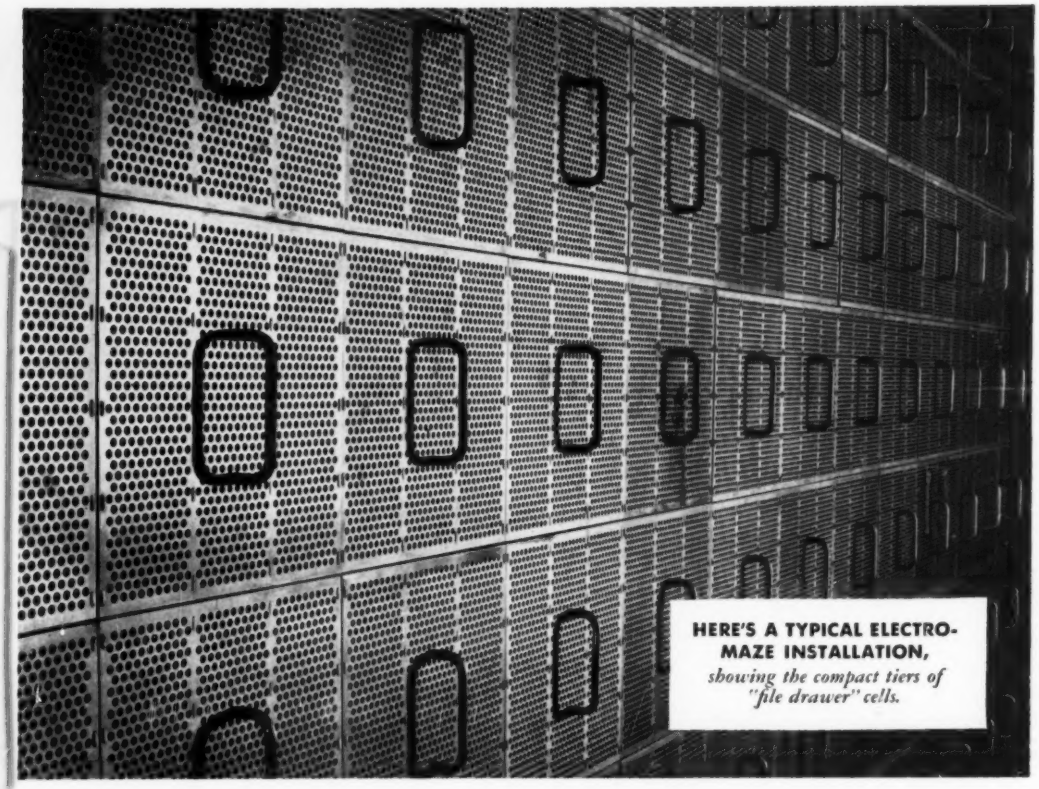
From bowling alleys to hospitals—in seventeen states—Electromaze air filters deliver super-clean air



HERE'S A TYPICAL ELECTRO-MAZE INSTALLATION, *showing the compact tiers of "file drawer" cells.*

IN HOSPITALS . . . bowling alleys . . . factories . . . stores . . . offices—where super-clean air is desirable—Electromaze electrostatic air filters are proving their value. Already users in seventeen states are benefiting from Electromaze's exclusive, new cellular design.

Electromaze, designed by Air-Maze, *the filter engineers,* is a new kind of electrostatic dirt precipitator made up of individual cells that slide in and out like filing cabinet drawers. This revolutionary design feature makes Electromaze easier and quicker to clean, more flexible in size. Electromaze "file drawer" cells are available in three sizes and can be combined to meet almost any space or capacity requirement.

Electromaze cells have two ionizing wires instead of one, providing more complete charging of airborne particles of dust, pollen, and smoke. All-aluminum plate construction resists corrosion and reduces weight. Self-adjusting power supply maintains optimum filtering efficiency, provides complete protection against even a complete short circuit.

For complete information on Electromaze, contact your nearest Air-Maze representative or write to Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

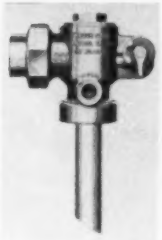
AIR-MAZE
THE FILTER ENGINEERS

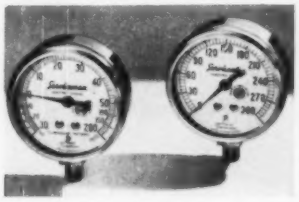
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

HPAC 4301—FLOW CONTROL VALVE—A new flow control valve with an air vent tube is available in five sizes (1 in. to 2½ in.) from H. A. Thrush & Co., Peru, Ind. It is designed for use on all automatically fired, forced circulating hot water heating systems.

The purpose of the valve is to vent quickly all air as it accumulates in the top of the boiler and to pass it directly into the pressure tank. Water going to the heating system is taken from the boiler several inches below the outlet opening.

The manufacturer states that the new valve not only puts air in the pressure tank where it serves a useful purpose but also makes unnecessary frequent venting of radiators, convectors, etc.





Refrigeration Test Gages
Left: Flow Control Valve

HPAC 4302—REFRIGERATION TEST GAGES—A new refrigeration testing gage set has been developed by Marsh Instrument Co., sales affiliate of Jas. P. Marsh Corp., Skokie, Ill. The set consists of a compound retard gage and a pressure gage for use with manifolds and for other testing.

Both gages have bronze bushed movements and are calibrated to within ±1.0 percent over their entire ranges. Knife edge pointers are provided to facilitate close reading and both gages have the company's "Recalibrator," designed to enable the user to restore the accuracy of a gage (that has been knocked out of adjustment) by merely turning a screw. This device is said to re-establish the relation of the bourdon tube to the movement so as to correct the gage throughout its entire range.

Both gages are in 2½ in. polished brass cases with bevelled glass crystals. The retard scale of the compound gage has 1 lb graduations throughout the range of 0 to 50 psi.

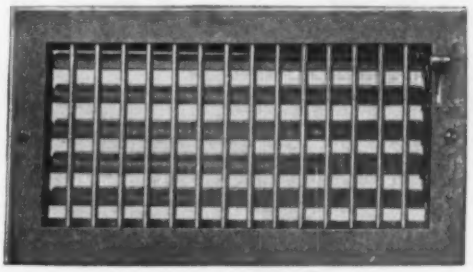
HPAC 4303—OIL PROTECTION CONTROL—A new type 275 control, designed to provide positive and economical protection against oil pressure failure on pressure lubricated refrigeration compressors, has been placed on the market by Penn Electric Switch Co., Goshen, Ind.

Actuated by the difference in pressure between the lubricating oil and the suction pressure of the compressor, the control incorporates two bellows-type power elements. These two pressures oppose each other in the control and the force generated by the difference between the two pressures operates the switch mechanism.

A trip-free time delay device with manual reset permits the equipment to operate approximately 90 sec after starting, to establish a minimum pressure difference. If the required pressure difference is not established in 90 sec, the control contacts open and the compressor will be stopped. Manual reset is then required to restart the compressor. If oil pressure drops below a safe minimum

AUER "Streamliner"

REGISTERS and GRILLES
—for high velocity Systems of
AIR CONDITIONING AND COOLING



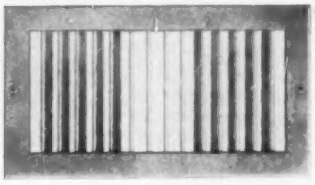
No. 1005V-HML. Single bank of adjustable bars, multi-louvre valve.

Streamliner wall registers and grilles afford a wide range of multiple deflection for air conditioning, ventilating, or cooling systems. They provide correct diffusion for high velocity outlets.

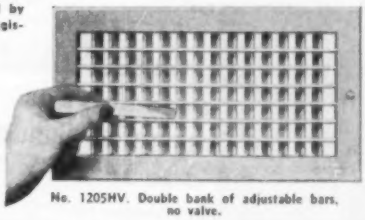
Bars are hollow moulded, beveled, perfectly formed, and smooth in contour. They are pivoted in the frame on special split sleeves, or expansion inserts, which furnish proper tension to hold bars firmly when set, yet allow easy adjustment to the desired angle with one simple tool. Bars are shaped like an airplane wing in cross-section, and pivoted at the exact center, so they can be turned completely around. Some users prefer to turn the thin edge outward for outlets (and the broader edge toward the flow of air) cutting resistance and turbulence to a minimum. Bars may be set at any angle, in any grouping. Shutters of multi-louvre valves are pivoted on rivets to prevent vibration. All Streamliner registers are equipped with gaskets. Write for Folder S-49 with sizes and list prices.

8 MODELS

The Series includes models with single bank of adjustable bars (vertical or horizontal), also with double bank of adjustable bars (vertical in front and horizontal in back, or the reverse), also all above four types with the addition of horizontal multi-louvre valves in the rear, controlled by lever on face of register.



No 1005V Single bank of adjustable bars, no valve.



No. 1205HV. Double bank of adjustable bars, no valve.

Order from your Jobber. Complete Auer Register Book—or Catalog "G" on perforated grilles — sent on request.

The Auer Register Co., 3608 Payne Avenue, Cleveland 14, Ohio

Auer REGISTERS
& GRILLES for AIR CONDITIONING & GRAVITY

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Blueprinted the Major Post-War Changes in

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From the drafting boards of Typhoon engineers came most important advances in post-war air conditioning... trail-blazing "firsts" that set a new trend, started a wave of re-designing throughout the industry. The major improvements pioneered by Typhoon have been fully proven in action – through topnotch performance in actual installations the world over. Typhoon... product of more than 40 years of air cooling experience...solidly engineered to help build a solid air conditioning business for Typhoon dealers.

COMPLETE LINE OF PACKAGED

AIR CONDITIONERS

1½ to 20 Tons

and Evaporative Condensers

3 to 20 Tons

Our District Sales Managers are ready to bring you complete information—write today for prompt action.

TYPHOON AIR CONDITIONING CO., INC.

794 Union Street • Brooklyn, N. Y.

during a running cycle, this time delay device permits the compressor to continue running for approximately 90 sec before shutting down. If the oil pressure returns to normal within this time delay period, the compressor will not shutdown. The pressure difference at which the control contacts will operate is adjustable from 0 to 60 psi. A choice of factory adjusted timing is available from 45 to 120 sec. Maximum allowable pressure on either pressure connection is 225 psi.

The device is also said to be ideally suited for many other applications where it is desirable to control a preselected difference between two pressures.

Oil Pressure Control

Humidity, Temperature Control Unit

HPAC 4304—HUMIDITY, TEMPERATURE CONTROL—A new "Aminco" test apparatus has been developed by American Instrument Co., Inc., Silver Spring, Md., to control precisely variations of temperature and humidity according to a predetermined plan.

Standard apparatus provides three temperature-humidity program schedules of interest to government laboratories and manufacturers supplying equipment to the government. Apparatus for other program schedules is available.

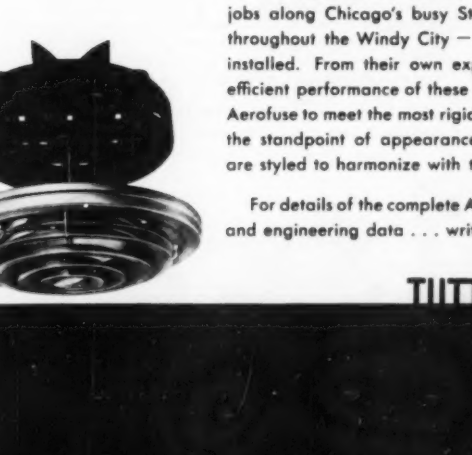
The equipment consists of a test chamber, an air conditioning unit, and a special control system. According to the manufacturer, the average maximum rise of dew point temperature (between 60 and 160 F) is +0.45 F per min, without load. The average maximum rate of fall of dew point temperature (between 60 and 160 F) is —0.75 F per min, without load. The average maximum rates of rise and fall of dry bulb temperature are equal to or greater in magnitude than for dew point temperature.

HPAC 4305—BACK PRESSURE, RELIEF VALVE—A new back pressure valve has been placed in production by Klipfel Valves, Inc., Div. of Hamilton-Thomas Corp., Hamilton, Ohio. Made in two types, it is said to be exceptionally accurate and durable. Type 135 VW is designed to maintain steam pressure at any point between 0 and 20 psi; type 136VW is an atmospheric relief valve for vacuum service. Both valves are said to be suitable for heating systems, power plants, and process applications where close regulation of large quantities of steam is required.

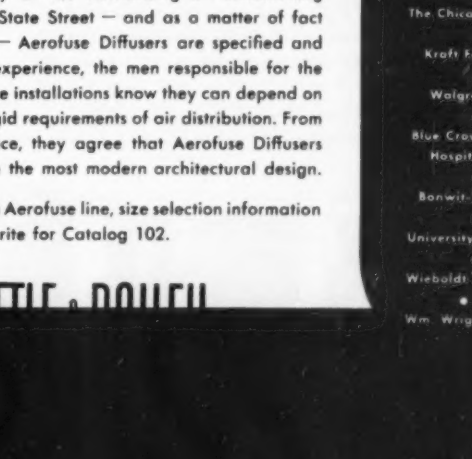
The new multiport valve has an inner valve which consists of an inverted cup which slides on a piston cast integral with the valve seat. Inlet pressure enters the chamber between the cup and piston through a restricted opening in the center of the piston. The narrow seating edge of the cup is designed to eliminate nearly all of the venturi effect of high velocity steam and, in addition, to make it an effective dashpot.

AEROFUSE IN BASKIN'S
(Home of Hart, Schaffner & Marx Clothes)

AEROFUSE IN BOND CLOTHES



AEROFUSE IN SPIEGEL, INCORPORATED



AEROFUSE IN F. W. WOOLWORTH COMPANY

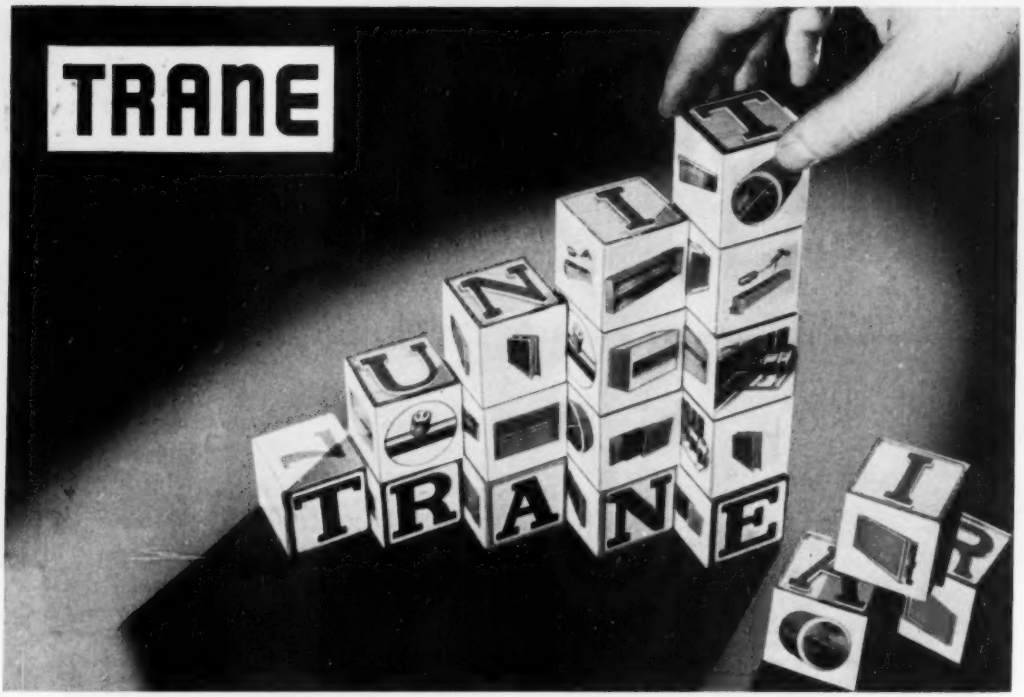
At vital point of air delivery on the outstanding air conditioning jobs along Chicago's busy State Street — and as a matter of fact throughout the Windy City — Aerofuse Diffusers are specified and installed. From their own experience, the men responsible for the efficient performance of these installations know they can depend on Aerofuse to meet the most rigid requirements of air distribution. From the standpoint of appearance, they agree that Aerofuse Diffusers are styled to harmonize with the most modern architectural design.

For details of the complete Aerofuse line, size selection information and engineering data . . . write for Catalog 102.

TUTTLE & BAILEY

OTHER TYPICAL AEROFUSE INSTALLATIONS IN CHICAGO

- Carson, Pirie, Scott Co.
- Sears Roebuck & Co.
- The Merchandise Mart
- The Chicago Tribune
- Kraft Foods Co.
- Walgreen Co.
- Blue Cross Plan for Hospital Care
- Bonwit-Teller Co.
- University of Illinois
- Wiebaldt Stores, Inc.
- Wm. Wrigley, Jr. Co.



You pick the parts...we'll build the Unit

With Trane Climate Changers it's as easy as stacking Junior's blocks to pick an air conditioner that is *exactly right for your job.*

Here's how: Trane mass produces fans, coils and other basic air conditioner parts. Take coils, for example. You can pick Trane coils for heating that use steam or hot water, high or low pressure, to deliver any temperature desired, any face velocity desired. Trane cooling coils may be picked to use water or direct expansion refrigerant—delivering any desired temperature; any air velocity.

Cabinets are designed so these heating and cooling coils can be included in any combination, with or without various styles of filters, humidifiers, air mixing accessories.

This all boils down to the fact that when you order a Trane Climate Changer, you can specify heating conditions, cooling conditions, moisture conditions, air velocity, and humidity.

In other words, you specify exactly the unit you need for the job. And we assemble the necessary elements from our broad, inclusive line.

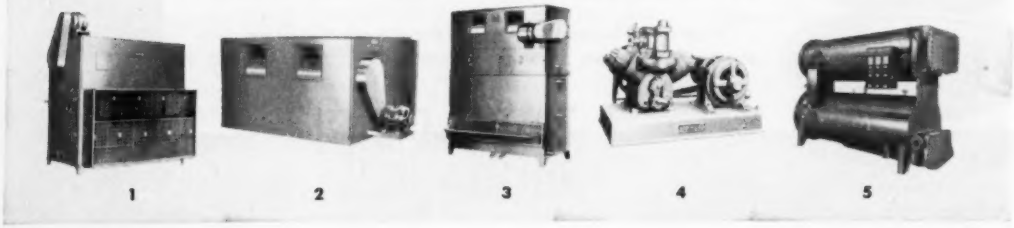
In effect, you are designing your own unit, using this short cut to correct air conditioning.

And it's economical, too—you are getting made-to-measure air conditioning at mass production prices.

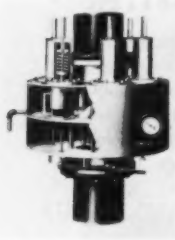
Ask the Trane Sales Engineer in your area to show you how Climate Changers are being used to meet heating, ventilating and air conditioning needs for industrial, commercial and domestic applications.

THE TRANE COMPANY...LA CROSSE, WIS.
EASTERN MANUFACTURING DIVISION, SCRANTON, PA.
Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties ... IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

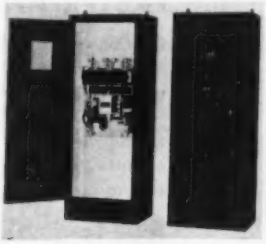
An endless variety of sizes and styles of Climate Changers, vertical (1) and horizontal (2); along with Evaporative Condensers (3); Compressor Units (4); and Turbo-vacuum Compressors (5); are typical of the broad Trane line.



According to the company, these new back pressure valves virtually eliminate wire drawing and hunting with pulsating flows because the individual valve units can be set to operate in sequence. Thus, at small increments of pressure, only one valve at a time is in throttling position.



Back Pressure Valve



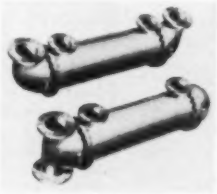
Solenoid Starter

HPAC 4306—SOLENOID STARTERS—The standard line of Bulletin 709, a-c, across-the-line solenoid starters of Allen-Bradley Co., 1335 S. First St., Milwaukee, has been extended by the addition of two new larger units. The size 6 starter is rated at 600 amp and the size 7 at 900 amp.

The switch construction follows the solenoid design that has been standard for sizes 0 to 5, inclusive. Both units have a one-piece magnetic plunger which operates with a vertical straight line motion. The fully enclosed double break, silver alloy contacts are said to require no cleaning, filing, or dressing. Both starters have adjustable thermal overload relays.

HPAC 4307—EVAPORATIVE AIR COOLER—A new line of evaporative air coolers is being marketed under the trade name "Imperial" by International Metal Products Co., P. O. Box 1712, Phoenix, Ariz.

Large pad area is said to be achieved by means of a distinctively designed hexagonal cabinet. The unit is manufactured in eight sizes, with air delivery capacities from 4200 to 14,400 cfm, in both horizontal and down discharge models.



Heat Exchangers

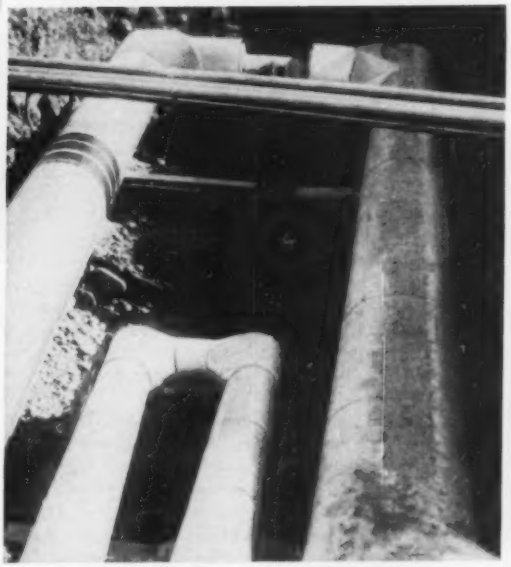
Left: Evaporative Cooler

HPAC 4308—HEAT EXCHANGER—Expanding its redesigned line of heat exchangers available from stock, Young Radiator Co., Racine, Wis., has developed type R (removable tube bundle) shell and tube heat exchangers.

Featuring standardization of parts, units are of corrosion resistant admiralty metal tubing. Large tube sizes (⅜ and ⅝ in. OD) plus proper tube spacing and baffling are said to provide long unit life, easy maintenance, and maximum heat transfer efficiency. The line

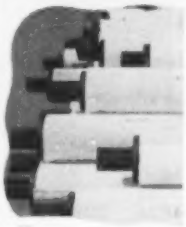
D.I.P.
REG. U. S. PAT. OFF.

Pre-Sealed Protection Built-In at Factory



- and Low Cost Installation Saves Time, Trouble and Work

Wherever you have a problem of conveyance of hot-water, steam or refrigerants, you can specify DURANT INSULATED PIPE with complete confidence in securing long range economy.



The combination of the best quality moulded insulation completely protected by non-porous asphalt merits the preference of architects, engineers, and contractors who have investigated the scientifically engineered construction methods employed in the fabrication of D. I. P.

Economy starts with installation. D. I. P. requires no tile, masonry, or sub-drains. Field joint work is simple, yet corrosion and electrolysis are eliminated. Low maintenance costs result in further economy over long years of dependable service.

Complete detailed information and engineering data on standard piping and special fittings will be furnished on request. Our representatives in principal cities are at your service.

PRE SEALED
REG. U. S. PAT. OFF.

DURANT INSULATED PIPE COMPANY
1015 Runnymede St. East Palo Alto, California

consists of both single and two pass models in a wide range of capacities.

Exchangers have been especially designed for cooling engine jacket water; lubricating oil for machine tools, reduction gears, pumping units, and turbines; cutting and quenching oils; industrial hydraulic equipment; generator sets; and miscellaneous fluids.

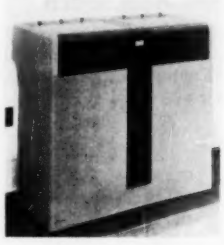
In the illustration, the upper unit is a single pass exchanger; the two pass style is shown below.

HPAC 4309—ROOM AIR CONDITIONERS—York Corp., York Pa., is marketing six new models of hermetically sealed room air conditioners which are said to feature the use of air filters, provision for year 'round ventilation, improved moisture removal, "finger-tip" controls, stale air exhaust, quiet operation, a five year warranty, unusual economy, and simple installation.

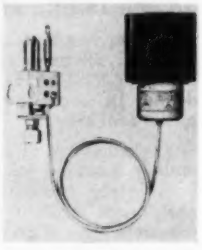
The two larger models, Nos. 150 and 200, are equipped with "Step-Matic" controls which function as a humidity balancer. Also, these two "Yorkaire" units (1½ and 2 hp) can be equipped with duct work attachments for conditioning multiple areas. Shown here is the 1½ hp model 150.

The ½ and ¾ hp units, known as models 12 and 23, are window sill units having a cooling maze coil of staggered tube and corrugated-fin design. Models 33 and 100 are ¾ and 1 hp console units respectively, and are set in veneer cabinets.

Because of the use of multiple refrigeration circuits these conditioners are said to offer the same advantages as do the firm's larger 3 hp and 5 hp conditioners.



Room Conditioner



Gas Pilot

HPAC 4310—AUTOMATIC GAS PILOT—Perfex Corp., 500 W. Oklahoma Ave., Milwaukee 7, has introduced a new series 1001 "nonflash" automatic gas pilot which employs an electric contact switch at a remote location from the liquid-filled bulb.

According to the company, gas cannot burn at the orifice. Another feature is said to be the large primary air port which enables the primary air to move at a low velocity—to prevent dirt or foreign matter being drawn into the pilot. The manufacturer also states that the pilot burns with a clean, blue flame under all field conditions and does not deposit carbon on the bulb. The orifice is held in place by a clip and the pilot is applicable to natural, mixed, or manufactured gas by means of an orifice change. No air adjustment is required when switching from one gas to another.

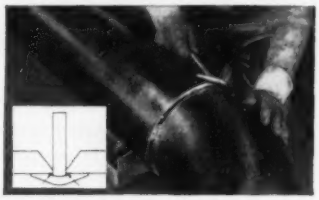
The pilot is available with a variety of mounting brackets and burner tips for virtually all types of burners.

HOW

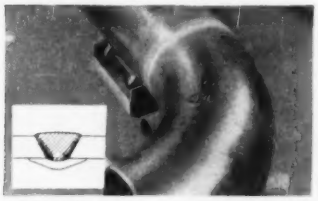
TO WELD PIPE FASTER AND BETTER

● The *only* completely engineered welding rings – Tube-Turn groove type rings with knock-off spacer pins – are the answer. They permit fast assembly with exact joint spacing and complete weld penetration. They're easy to use . . . save time.

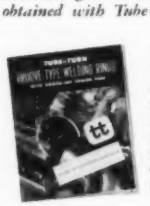
Ring snaps easily into place. Knock-off spacer pins space and center the pipe accurately and automatically.



Tacking completed, spacer pins are knocked off and the welder finishes his joint. Insert shows cross-section of ring and joint.



The finished job . . . a perfectly welded joint. Irregular black area (see insert) indicates greater width of fusion zone obtained with Tube-Turn welding ring.



FREE BOOKLET

Write today for free booklet "Tube-Turn Groove Type Welding Rings." Gives detailed, illustrated instructions on use . . . complete dimensions, weights, and prices.

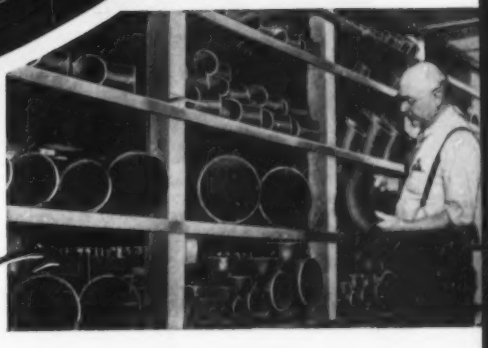
"Be Sure You See The Double tt"

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

In all the world there's only one "TUBE-TURN" Welding Fitting as shown by this trade mark... the right mark for every need in welding fittings and flanges.

TUBE-TURN



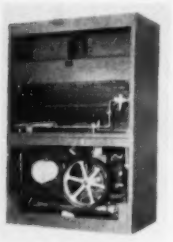
Your local distributor has a big stock. Get him on the phone!

TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY DISTRIBUTORS IN ALL PRINCIPAL CITIES

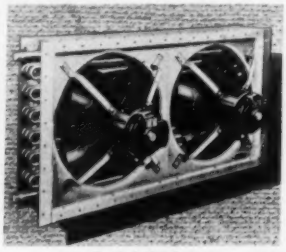
DISTRICT OFFICES: NEW YORK • PHILADELPHIA • PITTSBURGH • CHICAGO • HOUSTON • TULSA • SAN FRANCISCO • LOS ANGELES

HPAC 4311—PACKAGED AIR CONDITIONER—One of the attractions at the recent Southwest Air Conditioning Exposition was the 15-20 ton packaged air conditioning unit developed by Typhoon Air Conditioning Co., Inc., Div. of Ice Air Conditioning Co., Inc., 794 Union St., Brooklyn 15, N. Y.

With multiple installations of these units, says the company, there is "practically no limit to the size of buildings which can be air conditioned with packaged units." A special plenum chamber permits one-, two-, three-, or four-way discharge. Ducts can be connected to the top or back, depending on whether vertical or horizontal discharge is required. In the latter case, an 8 ft ceiling height is sufficient to clear the top.



Packaged Conditioner



Air Cooled Condenser

HPAC 4312*—AIR COOLED CONDENSER—The "Unicon" is a self contained, remote type air cooled condenser consisting of a coil, housing, fan, and motor. It is offered in six sizes (capacities from ¾ to 5½ tons of refrigeration) by Kramer Trenton Co., Trenton, N. J.

According to the manufacturer the unit may be placed near a window, wall opening, or any well ventilated space within a reasonable distance from the compressor. It may be furnished with a protective hood over the motors for outside mounting. It is said to be ideal for installations in an unheated space or where water is not available. It may also be used as a supplementary condenser. When used with a water cooled unit, it may be arranged to handle normal loads, with the water cooled condenser cutting in on high pressure during periods of peak load.

WE HEAR THAT . . .

Taylor Forge & Pipe Works, Chicago, has recently formed Taylor Forge & Pipe Works of Canada, Ltd., Hamilton, Ontario. Operations will start in a new building now being designed and it is expected that the new facility will be staffed with Canadian personnel. . . . . **Bethlehem Steel Co.**, Pittsburgh, has completed a substantial portion of the modernization and expansion program for its administrative facilities at the general office. The program provides for the construction of a three-story plant office building with an adjoining patrol headquarters building completely air conditioned, a three-story air conditioned addition to this structure, and a complete installation of air conditioning, with individual room control, throughout the main office building.

A record of more than 2.6 million man-hours of work without a single lost-time accident recently earned 425

Five fully automatic, electronically-controlled Enterprise Combination Gas-Oil Burners supply Prudential's 500,000 square feet of offices with year round heating comfort—plus plenty of piping hot water for every need. Boiler room, shown above, is equipped with 4 H2P burners rated 165 boiler HP, and 1 EP burner rated 65 boiler HP.

BURNER DIVISION OF ENTERPRISE ENGINE & FOUNDRY COMPANY

18TH & FLORIDA STS., SAN FRANCISCO 10, CALIFORNIA

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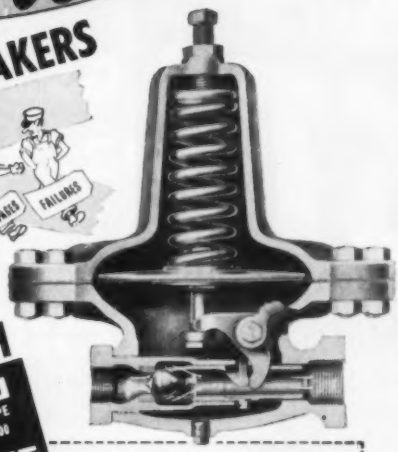
BIG MODERN BUILDINGS Are Efficiently, Economically Heated with *ENTERPRISE* *Oil Burners*

Providing heat and hot water in buildings like The Prudential Insurance Company's new Western Home Office in Los Angeles, is a job for which more and more Enterprise Burners today are specified. Available in a wide range of industrial and automatic sizes up to 650 boiler HP per unit, Enterprise Oil and Combination Gas-Oil Burners provide the ideal solution to heating problems for any type or size building. Specify Enterprise for the best in burners. Write for bulletins and full information.

ENTERPRISE
Oil *Burners*
The Choice of Heating Experts

IT'S GOODBYE Forever TO THESE TROUBLEMAKERS

IN PLANTS EQUIPPED WITH CASH STANDARD Streamlined PRESSURE REDUCING VALVES TYPE 1000



The Reasons Why IT HAPPENS ARE TOLD BY USERS AS FOLLOWS . . .

Check what the users say against the Benefit Points Below

• A Rubber Goods Manufacturer says—
"We have used these Type '1000' valves for several years with fine results on air or water service at pressures from 10 lb. to 300 lb. depending on requirements. These valves as claimed have been found to have **LARGE CAPACITIES.** On **FLUCTUATING LOADS** or **STEADY LOADS** they are **MOST DEPENDABLE, RAPID IN ACTION** with a **QUICK DEMAND** and **TIGHT CLOSING** when the load drops off. They require but a **MINIMUM OF SERVICE OR MAINTENANCE.**"

• A Chemical manufacturer says—
"The CASH STANDARD Type '1000' valves which we have in service have fulfilled the conditions checked . . . **(ACCURATE PRESSURE CONTROL UNDER TOUGHEST WORKING CONDITIONS), (TROUBLE FREE SERVICE), (TIGHT CLOSURE)** better than any other steam pressure reducing valves that we have used."

• A Metal Products company says—
"We have had a number of your CASH STANDARD Type '1000' valves in operation in our plant for a number of years. These valves have proved to be satisfactory in every respect. We particularly like this type of valve because it is **SIMPLE TO INSTALL, REQUIRES A MINIMUM OF MAINTENANCE,** and gives **CONTINUOUS** and **UNIFORM PRESSURE CONTROL.**

• A Plant Engineer says—
"We find that the CASH STANDARD Type '1000' streamlined valves are best suited for our various applications of compression molding because of their **VERY WIDE RANGE OF ACCURATE PRESSURE CONTROL.** The simplicity of construction of these valves has kept the **MAINTENANCE COSTS VERY LOW** which of course means a **SAVING IN COST OF OPERATION,** and **SPEEDIER PRODUCTION.**

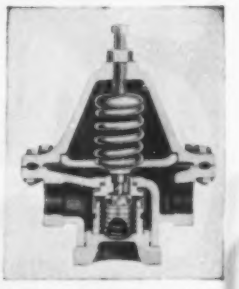
1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

WRITE FOR BULLETIN 962

CASH STANDARD CONTROLS . . . VALVES

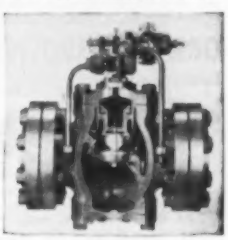
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

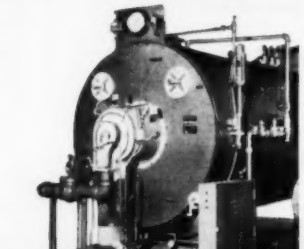
Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

CUT YOUR
STEAM
COSTS
as
%

O&S Powermaster Steam Generator



Plant operators in many industries are cutting costs up to 40% through advantages like these:

- Low fuel consumption through high efficiency
- Packaged design saves excessive installation costs
- Automatic operation frees engineer for other duties
- Mounted on steel base—no bricking required
- Delivered fully wired and tested—U. L. approved
- Widespread service by factory-trained men

High and low-pressure units—15 to 300 HP.—for light oil, heavy oil, gas or combination gas-oil firing. Free catalog mailed promptly—use coupon below.

ORR & SEMBOWER ®
Established 1885
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STEAM GENERATORS

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Please mail latest catalog showing Powermaster's cost-cutting advantages.

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Address_____

City_____ Zone_____ State_____

Westinghouse Electric Corp. employees a "Safety Oscar" in honor of their achievement. W. A. Beatty, manager of the feeder division, presented the trophy to employees in the tool and special equipment department of the division at the firm's East Pittsburgh works. The last lost-time accident occurred in the department in April, 1947. ..... In order to provide more office and storage space, the St. Louis branch of **Minneapolis-Honeywell Regulator Co.** and its **Brown Instruments Division** has moved into a newly constructed building at 4354 Olive St. It is the first branch office building to be built and owned by the company.

Hoffman Specialty Co., Indianapolis, has purchased the zoned controlled heating systems of **Webster Tallmadge & Co.**, East Orange, N. J. All operations pertaining to these systems are being conducted under the new name of **Webster Tallmadge Systems, Div. of Hoffman Specialty Co.** The new acquisition is a part of Hoffman's engineering division under the direction of A. O. Roche, Jr., chief engineer. D. C. Kellog, of the New Jersey firm, is now a sales engineer with the new division.

Lincoln Electric Co., Cleveland, has established a welder parts exchange plan. Old parts may be traded in for factory wound stators, armatures, and certain control parts. Standard prices in effect include trade-in allowances and the service is available from the company's 146 authorized field service shops. ..... As part of the Los Angeles main plant expansion program, **Fluor Corp., Ltd.**, has started work on a new engineering building. The two-story air conditioned building will have five drafting rooms accommodating 30 men each, 23 offices, a conference room, and other facilities.

The 1949 sales of industrial stokers of **Canton Stoker Corp.**, Canton, Ohio, held at practically the same level as 1948, the best year in the company's history, directors were told in a recent meeting. L. C. Dubs, president, foresees continued steady demand throughout this year and has noted a "recent marked increase in interest in coal and stoker firing despite the unsettled labor situation in the coal industry." ..... **Babcock & Wilcox Tube Co.**, Alliance, Ohio, has made adjustments in its prices of electric resistance welded, carbon steel mechanical tubing made from both cold rolled and hot rolled strip. The adjustments reflect increases or decreases in price depending on the size and gage.

Gallaher Co., Owatonna, Minn., and Omaha, Neb., has appointed the firm of **Balzer & Nightingale**, 4806 W. Chicago Ave., Chicago, exclusive representative in the Chicago area. ..... **Campbell Heating Co.**, Des Moines, Iowa, is completing an expansion program which will more than treble production facilities. A new plant addition, now nearing completion, will house sheet metal shops and provide additional storage space. Offices of the firm have already been moved to a new building.

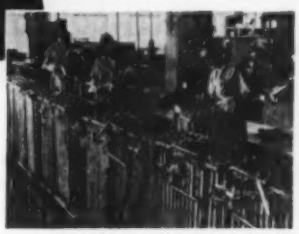
Sampsel Time Control, Inc., Spring Valley, Ill., has transferred the promotion, sale, credit, and collection activities of its sales department to **T. French Co.**, 920 Baldwin Bldg., Erie, Pa. All inquiries, purchase orders, and related correspondence, together with the establishment and administration of sales policies, prices, and discount schedules, will be handled in Erie where stocks

Take advantage of this

UNEQUALED EXPERIENCE
UNEQUALED PRODUCTION

Aerofin manufactures finned heat-transfer surface exclusively. The experience gained by such specialization permits the selection of just the right surface and materials for each particular job — for each application.

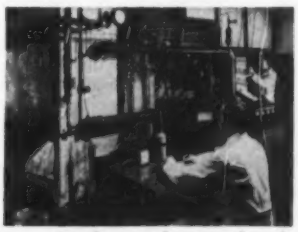
When you specify Aerofin finned heat-transfer surface, you specify high efficiency, long life and easy maintenance. As pioneer in the field, Aerofin has developed unequaled know-how and production facilities to apply to your particular heat-transfer application. Continual research accounts for the accuracy of Aerofin's published ratings. You can use them with full confidence.



Attention to the many details that make up the completed unit typifies the Aerofin way. For instance, in this particular coil, careful brazing of the return tubes to the header plates assures leak-proof construction.

Throughout the Air Conditioning Industry—

Aerofin units do the job Better, Faster, Cheaper



Aerofin controls every phase in the production of its finned heat-transfer coils and units. This control is maintained by rigid specifications and inspection, and all assembly is done in the Aerofin plant.

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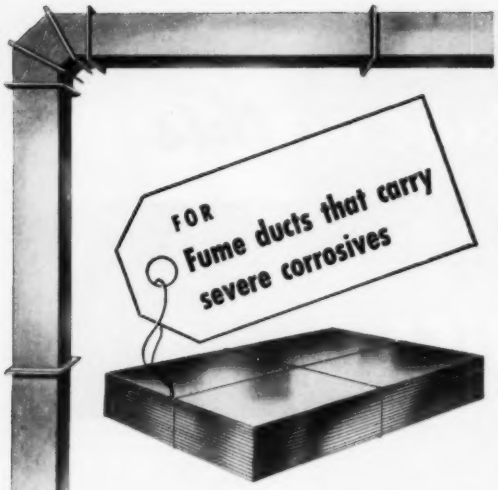

THE NEW DURIMET 20, ANTI-CORROSION SHEET AND PLATE

As Easy To Fabricate As Ordinary Stainless

To give the fume hoods and ducts in your chemical laboratory lasting corrosion-resistance make them of the new Durimet 20 sheet.

This newly developed form of Durimet 20 can withstand really tough corrosives. Its resistance is far better than ordinary stainless steels or even previous analyses of Durimet.

This corrosion resistance is as permanent, uniform and thick as the sheet itself. There is no lining to chip, crack or spall and leave the duct vulnerable. A Durimet 20 duct encloses laboratory fumes with a solid wall of corrosion-resistance.

This special stainless steel can be easily fabricated by methods familiar to ventilating contractors experienced in handling 18-8 stainless. It forms a light, strong, lasting fume passageway. Use it for laboratory table tops, sinks and troughs, too.

Write for Bulletin 502.

THE DURIRON CO., INC. • DAYTON 1, OHIO

Branch Offices In Principal Cities

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

of heating controls will be maintained for emergency shipment. Most shipments, as well as repair and replacement items, will be handled at the factory or at one of the authorized repair and service stations.

Union Malleable Mfg. Co., Ashland, Ohio, has opened a new warehouse to serve customers in Texas, New Mexico, Arkansas, Louisiana, and Oklahoma. Located at the corner of Kentucky and Presidio Sts., Fort Worth, the warehouse is under the direction of Lester Wingard.

Temperatures up to 464 F, chemical solvents, salt spray, oil, and high humidity are used in a special "torture chamber" of **General Electric Co.**, Schenectady, to prematurely "age" electric motor parts. The tests are part of a program begun more than 10 years ago and are designed primarily to test the serviceability of motor insulation. Aldo Macchi, of G.E.'s air conditioning department, has been awarded a patent covering a burner head for use in oil fired boilers. This, his 11th patent, covers improvements which are said to provide better cooling of the electromagnetic oil flow control valve and atomizing nozzle parts. The atomizing nozzle structure can be varied to provide different oil rates.

As a practical aid to selling air and vacuum valves for one pipe steam radiators, **Dole Valve Co.**, 1933 Carroll Ave., Chicago 12, is offering dealers a new and handy "merchandiser" for point-of-sale use. It is a counter case for displaying a representative selection of 12 air and vacuum valves. A recessed space is provided for each valve with an identifying caption that also includes a brief description of appropriate applications.

Pittsburgh Corning Corp., 4th & Wood Sts., Pittsburgh, is producing seven new PC glass blocks known as the 55 line. They are said to permit a more uniform panel appearance, and result in better brightness control.

Functional features of the new blocks include the company's "Soft-Lite" edge treatment (opal glass fused into the block junction to diffuse light which would otherwise be transmitted directly through the block edge), a fibrous glass insert used to further diffuse light transmitted by the block itself and also used to light directly prisms on the interior faces of certain patterns. These features are combined in the blocks in accordance with the functional use for which the specific block has been designated. Some blocks are designed for use on south elevations, others for north elevations; light-directing blocks and light-diffusing blocks are available for these special applications. The blocks with fibrous glass inserts are said to increase the light-diffusing effect on extremely sunny exposures.

The **Kaylo Div., Owens-Illinois Glass Co.**, Box 1035, Toledo 1, Ohio, should have been included under the following headings in the Directory Section published in the January issue of HPAC: Insluation, Boiler and Tank; Insulation, Building; Insulation, Duct, Thermal; and Insulation, Pipe.

CLOG-PROOF

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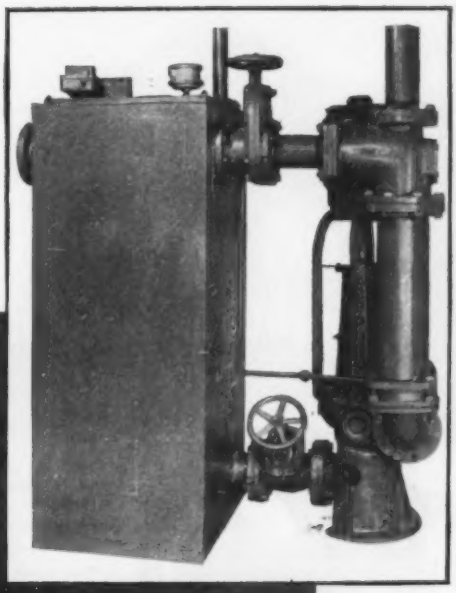
RELIABLE



There's no substitute for
The "Chicago"

FLUSH-KLEEN

Sewage Ejector of Proved Performance

"Flush-Kleens" are positively clog-proof . . . the impellers handle nothing but strained sewage, minimizing wear and maintaining pump balance. Specially designed for plumbing systems in buildings where the maximum inflow is not more than 50 GPM. A second unit can be added any time, to make a duplex installation.

Look at These Long-established Facts

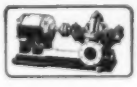
- "Flush-Kleens" are the only absolutely clog-proof sewage pumps; impellers are not required to pass any solids.
- The "Flush-Kleen" will pump anything that will pass through the pipe regardless of type or quantity of material.
- "Flush-Kleen" needs no manual attention other than lubrication and inspection. No labor is needed to dis-assemble and clean.
- "Flush-Kleen" selection is not limited to a narrow pumping range. The impeller maintains dynamic balance over a wide range, preventing strain on shaft and bearing.

Write for further information and test data on Chicago Pump Company "Flush-Kleen" Sewage Ejectors.

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**



Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

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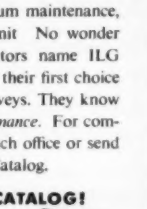
The only fan with the ILG Self-Cooled Motor!

✓ ENGINEERED SPECIFICALLY FOR EXHAUST FAN DUTY
✓ CERTIFIED RATINGS ... CFM and DECIBEL
✓ DIRECT-DRIVE
✓ ELECTRICALLY BALANCED FAN WHEEL
✓ SCIENTIFICALLY STREAMLINED
✓ "ONE-NAME-PLATE" RESPONSIBILITY

Built like a fine watch!

It gives you the low operating cost of an open type motor with the protection of a fully-enclosed motor! You save 5% to 10% on power costs. The motor never "gums up", requires minimum maintenance, adds to long life of the entire unit No wonder engineers, architects and contractors name ILG Self-Cooled Motor Propeller Fans their first choice year after year in independent surveys. They know that ILG quality *pays-off in performance*. For complete information, call nearby branch office or send coupon for FREE Propeller Fan Catalog.

GET FREE PROPELLER FAN CATALOG!



ILG ELECTRIC VENTILATING COMPANY
2841 North Crawford Avenue, Chicago 41, Ill.
Offices in more than 40 Principal Cities

☐ Please send me FREE copy of Propeller Fan Catalog No 148

Company Name_____
Executive's Name_____
Address_____ Zone_____
City_____ State_____

WHO'S WHAT

The **Blast Coil Manufacturers Institute** has elected H. Blake Thomas, of McQuay, Inc., president. Other officers of the institute serving with him are: vice president—H. C. Rooks, The Trane Co.; and secretary-treasurer—William P. Raffone, G & O Mfg. Co. ..... **Joseph A. Martino,** president, **National Lead Co.,** has been elected to the board of directors of **Allegheny Ludlum Steel Corp.** The two firms recently formed **Titanium Metals Corp. of America,** a jointly owned company.

McDonnell & Miller, Inc., Chicago, has elected **George H. LaRoi** vice president and **James A. Solon** treasurer. For a number of years both men have played important roles in the company's growth. ..... After 31 years as general manager of the manufacturing division of **Weil-McLain Co.,** Michigan City, Ind., **W. R. Stockwell** has retired. During his years of service and under his direction a boiler plant and a radiator plant were built. He is a former chairman of the Institute of Boiler and Radiator Manufacturers and for many years was a member of its executive committee.

Charles B. Belknap, coordinator of research, Owens-Illinois Glass Co., is now on the board of directors of **Arthur D. Little, Inc.,** Cambridge, Mass., research and engineering organization. Long active in the administration of industrial research, he was formerly executive vice president and vice chairman of the board of directors of Owens-Illinois. ..... **James H. Binger** is now vice president and general manager of the **Belfield Valve Div., Minneapolis-Honeywell Regulator Co.,** Philadelphia. He joined Honeywell in 1943, two years later was elected assistant secretary of the company, and in 1947 was made assistant vice president and transferred to the sales department.

F. H. Clark has been named sales manager for the standard control division of **Westinghouse Electric Corp.** at Beaver, Pa. He has been in charge of the small a-c control sales section of the division. **Glenn A. Caldwell** is now engineering supervisor of the company's Detroit engineering and service department. For the last three years he has been manager of industrial control engineering. ..... **Wayne D. Staley,** formerly New York district manager for **Duriron Co., Inc.,** Dayton, Ohio, has been appointed general sales manager and has replaced **D. E. Jack** who has resigned as vice president in charge of engineering and sales. **R. F. Sharpe,** former manager of the Philadelphia office, is now in charge of the New York office, and **Ralph L. Watts,** sales engineer in New York, has succeeded Mr. Sharpe.

For the past three years **Charles J. Ramsburg, Jr.,** has been assistant district manager in the New York office of **Spang-Chalfant Div., National Supply Co.,** Pittsburgh. He is now the Pittsburgh district sales manager. ..... **Martin V. Coffey** is the new general sales manager of **Philip Carey Mfg. Co.,** Cincinnati. He was formerly sales manager of the company's Miami-Cabinet Division. ..... **Minneapolis-Honeywell Regulator Co.,** Minneapolis, has opened a new branch office in Binghamton, N. Y. **Sam Hauser,** of the Syracuse office, is in charge

BRUNNER SINCE 1906 AIR CONDITIONING builds business

Let's cut out the BLANDISHMENTS!

You are in business to make money. So are your customers. So are we.

Brunner put 44 years of experience and a mighty valuable reputation into the design, development and marketing of this new line of self-contained floor-type room air conditioners.

As a product we know it has the last word when answering the questions of user-buyers—price, good looks, dependability, capacity, etc., etc.

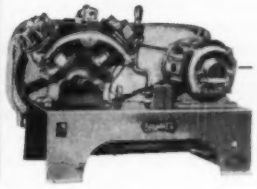
The market for self contained floor type air conditioners hasn't been scratched. It is a *big* market, easy to contact, easy to sell and unit installation is simple.

So there you are. You want more profitable business. Your potential customers need air conditioning to protect and develop their business. Brunner has the product. It costs you nothing to find out whether or not Brunner Air Conditioning really does offer a worthwhile greater income.

Write or wire for a Brunner factory representative to show you the facts.

BRUNNER SINCE 1906 AIR CONDITIONING

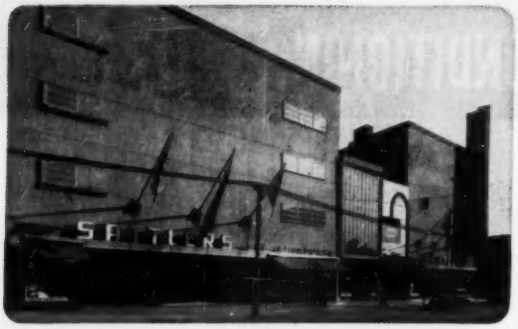
- **Self Contained 3 HP. to 10 HP.**
- **Remote Type 5 HP. to 75 HP.**



BRUNNER MANUFACTURING CO., Utica 1, New York, U.S.A.

REFRIGERATION CONDENSING UNITS by BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS—*a size and type for every purpose...*¼ **HP. TO 75 HP.**

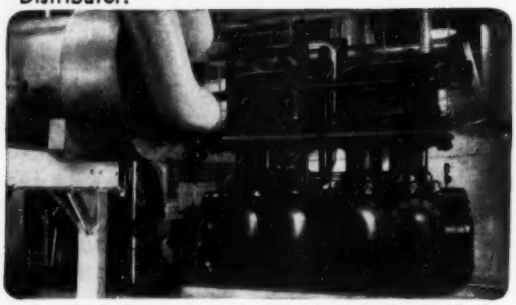


Buffalo's Largest Store Air Conditioned throughout with Frick Refrigeration

Sattler's Department Store, covering most of a large city block, serves up to 150,000 people in a single day. The giant store is cooled in hot weather with ten Frick ammonia compressors using 920 horsepower. Installation by Mollenberg-Betz Machine Company, Frick Sales Representatives at Buffalo.

All Departments are Air Conditioned

For that important air conditioning, ice-making, refrigerating or quick-freezing job of yours, get in touch now with the nearest Frick Branch or Distributor.



Ten Frick Compressors Are Installed on the Roof of Sattler's Store at Buffalo.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

and is responsible in that area for the sales of products made by the company's heating controls division. Products made by the firm's commercial and industrial divisions will continue to be handled from the Syracuse office.

Greswold Van Dyke has been appointed executive director of **Stainless Steel Producers—American Iron and Steel Institute,** an organization of 17 producers and suppliers for further development of stainless steel uses. He was associated for 29 years with Joseph T. Ryerson & Sons, Inc., where he was manager of the special steel division. ..... **Col. Frank R. Cook,** chief of an Air Force headquarters division at Washington, has joined **Minneapolis-Honeywell Regulator Co.,** Minneapolis, as director of aero engineering. Colonel Cook has retired from the Air Force after 17 years of service.

Hoffman Specialty Co., Indianapolis, has promoted **Woody W. Dillon** to the position of sales manager. With the firm 20 years, he had most recently been assistant sales manager, and has now succeeded E. L. Malm who resigned to assume new duties with U. S. Radiator Corp. ..... **Roy A. Curl,** assistant to the sales promotion manager for 15 years, has been named manager of the sales promotion department of **Youngstown Sheet and Tube Co.,** Youngstown, Ohio. He has succeeded **Myron S. Curtis,** now assistant to the president.

Dr. Harvey Agnew, M.D., executive secretary of the Canadian Hospital Council since its origin in 1931, has joined the firm of Neergaard & Craig, New York City. Specializing in consulting service relative to hospital planning, organization, and management, the firm is now known as **Neergaard, Agnew, and Craig.** A divisional office has been established in Toronto, Ontario, under Dr. Agnew's direction. ..... **Melvin O. Monsler** is managing sales of the welding division of **Harnischfeger Corp.,** Milwaukee. He has been with the company for 12 years, serving for four years as assistant sales manager of the division and one year as a welding product service engineer.

As the new manager of research and development for **Peabody Engineering Corp.,** New York, **Stephen A. Sloan** is responsible for extending the company's present line of equipment and developing new products. He joined the firm in 1943 and has been managing the air heater department. ..... **Walter D. Myers, Jr.,** formerly in charge of industrial insulation sales in the New York area, is the new sales manager of the industrial insulation department of **Eagle-Picher Co.,** Cincinnati. He has succeeded **Douglas Via** who resigned to join King Roofing & Heating Co. and Affiliates as general manager.

E. M. Mittendorff, for many years identified with the heating, ventilating, and air conditioning field, is taking a year's leave of absence from the firm of **Kramer & Mittendorff. F. W. Kramer** will continue the operation of the firm representing Cleaver-Brooks Co., Union Iron Works, Davis Engineering Co., and Barnes & Jones, Inc., in the Chicago area. ..... **Ilg Electric Ventilating Co.,** Chicago, has named **George C. Jelliffe** as eastern district manager with headquarters in New York City. He joined the company in 1946 and worked from the New York

C-E assures you the right stoker

***RIGHT* for your available coal • *RIGHT* for your boiler design • *RIGHT* for your load conditions**

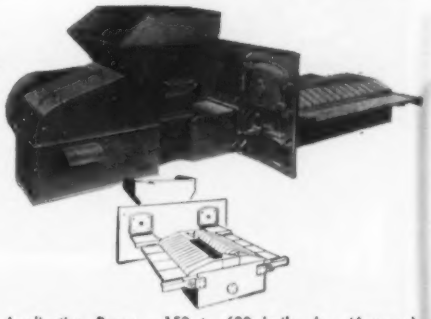
When you buy a stoker you want the type best suited to *your specific requirements*. You are sure of getting just that when you turn to Combustion Engineering–Superheater. Why? Because a background of more than 20,000 C-E Stoker installations (above residence size) makes available to you an accumulated experience unmatched by any other stoker manufacturer.

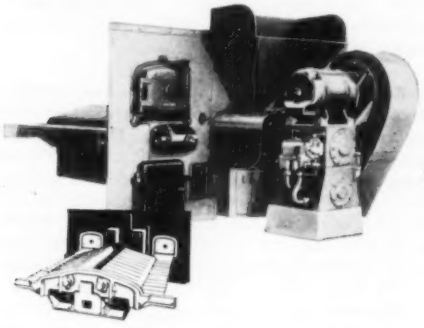
In addition, Combustion offers you the most complete line of stokers available today, typical of which are the three types shown below. Collectively C-E Stokers meet every fuel and load requirement. Therefore, as the manufacturer of *all* types of stokers, Combustion can give impartial advice in helping select the *right* stoker.

And at today's cost of coal, getting the *right* stoker can pay handsome dividends. For, in an average installation, the cost of coal used in a year exceeds — often several times — the initial cost of the stoker.

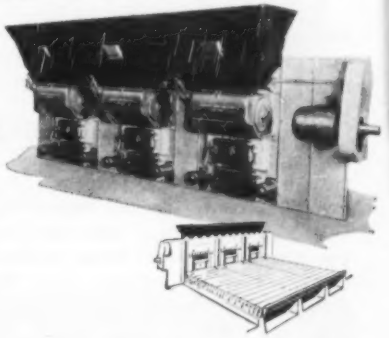
All over the country, C-E Stokers are getting operating results as good or better than those anticipated at the time of purchase. In short, they are the *right* stokers for the job they were selected to do. So the next time you are in the market for stoker equipment, talk it over with Combustion before you buy. B-372A

SKELLY STOKER UNIT Application Range — 20 to 200 boiler hp. (Approx.)
A compact, self-contained underfeed stoker. Designs for either anthracite or bituminous coal. Alternate fixed and moving grate bars assure lateral distribution of fuel and maintains a clean porous fire. Cantilever dump grates simplify ash removal. Integral forced-draft fan permits positive regulation of air-coal ratio. Variable-speed transmission. Automatic control is standard. Timken bearing equipped. Alemite lubrication.





TYPE E STOKER Application Range — 150 to 600 boiler hp. (Approx.)
A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals, particularly those having caking and coking characteristics. Has ram type feed and reciprocating sliding bottom. Hollow, air-cooled grate bars are arranged in an alternately fixed and moving relationship to condition the fuel bed and assure its steady movement to the dump trays. Air supply is under zoned control. Provision for air over the fire. Available with steam, electric or hydraulic drive.



SPREADER STOKER Application Range — 150 boiler hp. up to units producing 200,000 lb of steam per hr, or more.

Available in both dumping grate and continuous discharge types, this simple, rugged stoker is designed to burn a wide variety of coals. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Grate surface is zoned for regulating air admission and to facilitate cleaning. All parts subject to wear are readily accessible. Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.

C-E

Combustion Engineering–Superheater, Inc.

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

. . . and it's safer, too

Save space in mounting . . . get convenient, safe operation. Ward Leonard's new 4120 AC Combination Magnetic Starter with Disconnect Switch is *front-operated.*

Disconnect switch is compact, self-contained unit. Capable of interrupting maximum locked rotor currents.

No dead center—Switch throws to *full* ON or OFF—no faulty indication. Also, mechanical interlock prevents opening door when switch is ON.

Write for new Bulletin 4120. WARD LEONARD ELECTRIC CO., 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

office as an assistant to P. D. Briggs, vice president and general sales manager. . . . . At the recent annual meeting of the **Aluminum Association, R. S. Reynolds, Jr.,** of the Reynolds Metals Co., was elected president for this year. **A. V. Davis,** Aluminum Co., of America, was re-elected chairman of the board.

Long identified in the field of heat generation and heat exchange, **Edward T. Alstrom** is the new general sales manager of **Crotty Mfg. Corp.,** Flushing, N. Y. . . . . **Robert J. Flanagan** is now advertising and sales promotion manager of **Mitchell Mfg. Co.,** Chicago. He has succeeded **Armand S. Zucker** who has taken over the newly created post of director of design and development. . . . . **Kenneth G. Jobson,** manager of the cylinder maintenance and testing department, The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., New York, has been elected president of the **Compressed Gas Association.**

Dr. Hamnett P. Munger, who has had 20 years of varied industrial and professional experience in chemistry and chemical engineering, is now coordinating air pollution research activities of **Battelle Memorial Institute,** Columbus, Ohio. He is also acting in a liaison capacity between industry and the institute which he joined in 1948. . . . . **Guy C. Stoltz,** who has been manager of the Detroit office of **Carrier Corp.,** Syracuse, N. Y., is now the Houston dealer branch manager. He had also previously served as dealer engineering advisor in the company's southwest district.

White-Rodgers Electric Co., St. Louis, has opened a new office at 210 Long Lane, Upper Darby, Pa., to serve Philadelphia and the surrounding area. **H. F. Killinger** is Philadelphia district manager. . . . . **Timken Silent Automatic Div., Timken-Detroit Axle Co.,** Jackson, Mich., has named **Eric H. Ryden** as a gas heating project engineer. He came to this country from Stockholm, Sweden, in 1921 and for the past five years has been engaged in the development of gas and oil heating equipment.

Pyle-National Co., Chicago, has appointed **George R. Grove** as a service engineer for railroad products. His headquarters will be in Chicago. **Edgar Faust** has been named a sales representative in the Chicago area and **Harold V. Engh, Jr.,** a sales representative in New York City. . . . . **Engineering Sales Co.,** 171 Audubon Blvd., New Orleans, is headed by **Walter B. Moses, Jr.** The firm is a new special refrigeration and air conditioning representative of **Patterson-Kelley Co., Inc.,** East Stroudsburg, Pa. . . . . Formerly technical advisor in research and development on coal, gas, and petroleum technology at Battelle Memorial Institute, **Carl E. Miller** is now on the industrial department engineering staff of **Combustion Engineering-Superheater, Inc.,** New York.

Hal Crumly, Pomona, Calif., has been elected president of the **Refrigeration and Air Conditioning Contractors Association of Southern California, Inc.** Other officers, all of Los Angeles, serving with him this year are: vice president—**Don Beck,** W. S. Kilpatrick Co.; secretary—**Dale J. Missimer,** Pacific Refrigeration Co.; treasurer—

Send for the PROFIT STORY!

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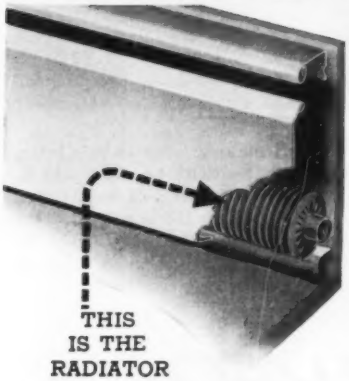
BASEBOARD HOT WATER RADIATION



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BOILER-BURNER UNIT

THE COMPLETE FLOORLEVEL PACKAGE is packed in 3 cartons: (1) Heating elements, (2) Baseboard front panel and top moulding, (3) All miscellaneous fittings . . . Packaged in 6 different sizes for 200, 233, 263, 300, 333 & 366 sq. ft. radiation . . . for all size homes. *Designed for use with all types of hot water heating systems.* Circulators, flow valves and controls in required sizes.

THE DE-AIRATOR TANK UNIT is specially designed for *positive elimination of air* in hot water systems . . . Also acts as an expansion tank. Available for use with the following size installations: 500, 1000, 1500 sq. ft. of radiation.

Send for SPECIFICATION 56-E

Since 1923

GENERAL Automatic

General Automatic Products Corp., 2300 Sinclair Lane, Baltimore 13, Md.
(Formerly General Oil Burner Corp.)

Glenn M. Schlegel, Manual Arts Sales Corp. The association was formerly known as the Refrigeration Contractors Association, Inc. ..... **William B. Moore, Jr.,** has joined **Reynolds Metals Co.,** Louisville, as a technical service engineer. He was formerly a construction officer with the 35th U. S. Naval Construction Battalion and was also chief engineer of the Institute of Industrial Research, University of Louisville.

D. L. Getz, chief engineer, Steel Products Engineering Co., has been named chairman of the engineering and research committee of the **Stoker Manufacturers Association.** He succeeds **Joseph G. Beard,** resigned. .... **F. H. Herndon,** president, Herndon Sales & Service Co., is the newly elected president of the **Midwest Stoker Association.** Other officers elected for the ensuing year are **P. I. Bohmann,** vice president, and **Charles H. Wilson,** secretary-treasurer. Mr. Bohmann is regional manager of U. S. Machine Corp. and Mr. Wilson is manager of Park Heating Sales, stoker distributor. ..... **Himmelblau Associates,** Chicago distributor of mechanical equipment, is now representing **Finn & Co.,** New York City.

H. S. Colby, widely known in the boiler and steam generating field, has joined **Springfield Boiler Co.,** Springfield, Ill. He was formerly identified with Riley Stoker Corp. and Combustion Engineering Co., Inc. The Springfield company has recently appointed **Power Equipment Co.,** 4706 Holly St., Kansas City, Mo., sales representative in the Missouri valley and western plains area north of Texas, including the Rocky Mountain area and the states of Wyoming, Montana, and North Dakota. Principals of the Missouri firm are **C. C. Wilson, J. M. Maag,** and **K. F. Cramer.** ..... **Vapor Heating Corp.,** Chicago, has transferred **Leroy Dougall** from headquarters to St. Paul, Minn., where he will work with railroads on service problems in Minnesota, Iowa, Wisconsin, the Dakotas, and Washington.

The **Falk Corp.,** Milwaukee, has made a number of recent personnel changes. **Arthur L. Larson** is now assistant to the sales manager and has also moved up to the position of manager of the sales inquiries division. **William J. Urban,** former special representative in coupling sales, is now managing coupling sales. The new manager of distributor sales is **Don K. Lambert,** previously a special representative in the division. **Roland E. Govan** heads sales promotion, a newly organized department. Three former sales trainees have been appointed to district sales office staffs. **Nile E. Sweet,** of the distributor division goes to Detroit. **Harold C. Fleischer** has transferred to the New York Office, and **Elliot G. Heuser** has been assigned to the Wisconsin sales division.

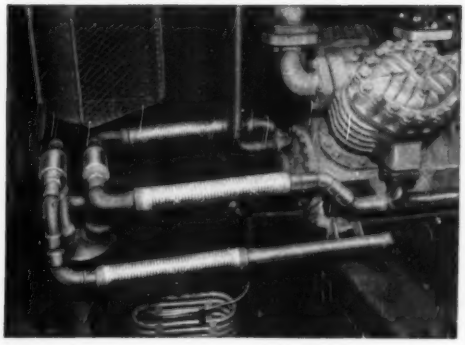
A package idea in merchandising firing tools is being featured by **Cleveland Steel Specialty Co., Inc.,** 3773 E. 91st St., Cleveland 5. Four newly designed tools (rake, slice bar, poker, and hoe) are marketed in seven lengths either as individual items or as complete sets of four tools matched for length and weight and balanced for easy handling. A three prong clinker tong completes the line.

Another Problem **SOLVED**

ELIMINATING COMPRESSOR VIBRATION

with Bendix

Eclipse Flexible Metal Hose



Twenty-four-hour operation of a huge icebox for cold testing (to −83° F.) aircraft instruments, plays a vital role in maintaining the supply line to today's multi-engined and supersonic aircraft. Greater assurance of a continuous duty refrigerating plant was given with the installation of Bendix Vibration Reducers for absorbing compressor vibration. Manufactured from seamless drawn tubing, the deep parallel corrugations and uniform wall thickness assure maximum flexibility and service life. Bendix Vibration Reducers in standard sizes—all chemically cleaned and sealed—are available from stock. Special assemblies can be engineered to your requirements. Write today and let our engineers work out your problem with you.

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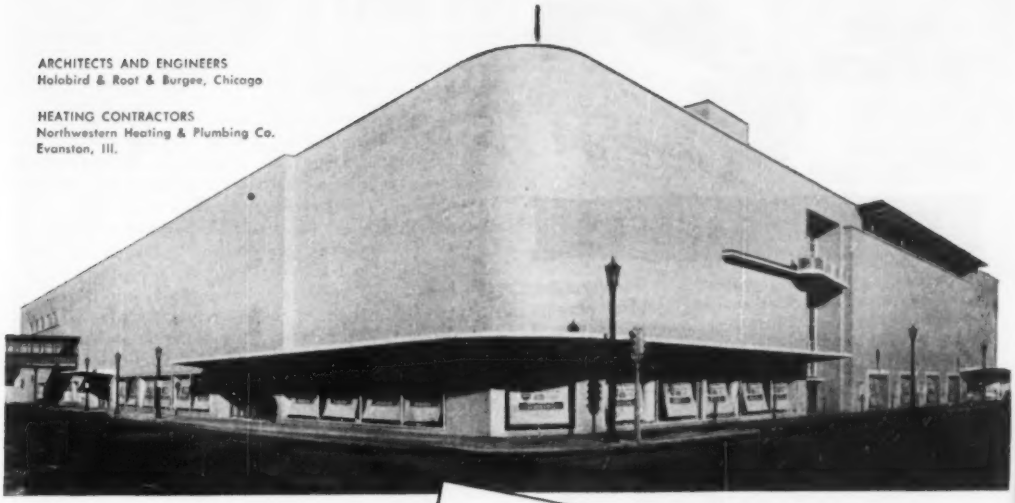
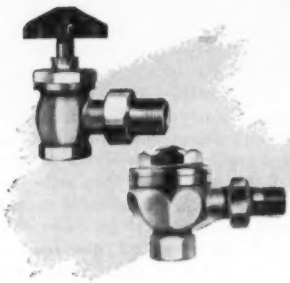
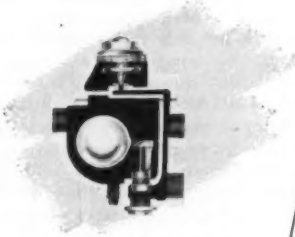




Marsh Packless Valves—the truly packless metal-to-metal seal valves—and dependable Marsh Radiator Traps are widely used in the Evanston Wieboldt store.



Many Marsh Float and Thermostatic traps play an important part in the Wieboldt unit ventilating system. The Marsh No. 12 trap, illustrated, is typical of these dependable traps which include Marsh No. 8 and No. 14 traps.

This magnificent new WIEBOLDT *Evanston Store is Marsh Equipped*

Newest achievement of the ever-growing Wieboldt organization is the nearly completed Wieboldt department store in the bustling retail section of Evanston, Ill., close-in suburb of Chicago.

From the big, modern 700-car parking lot, to the skillfully planned store layouts, every detail of this imposing structure has been conceived to set new standards in merchandising efficiency and convenience. As modern as the building is the elaborate unit heating and ventilating system. Every piece of equipment entering into the system has been critically chosen to contribute the maximum efficiency and dependability.

In this building, as in so many important buildings, Marsh equipment was chosen. Marsh packless Radiator Valves, Radiator Traps, Float and Thermostatic Traps and other heating specialties are installed in all parts of the heating system.

Ask for facts about Marsh valves, traps and venting devices—the dependable, time tested equipment that is preferred by the most discriminating heating men.

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
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MARSH *Heating Specialties*
SINCE 1865

ASK ADSCO

to help you select the right

Few heating or cooling problems are exactly alike. In some cases, standardized equipment can be adapted for installation, with substantial savings in cost and delivery time. On the other hand, many problems require specially designed units to meet specific needs.

In either case, ADSCO can provide the right equipment, expertly designed and fabricated. ADSCO offers a complete line of standard or custom-made heat exchangers in a wide variety of types.

STRAIGHT-TUBE FLOAT HEAD HEAT EXCHANGER with Removable Bundle

This ADSCO unit has extensive applications in many fields. It can be furnished as shown or with non-removable bundle. Tubes may be of copper, stainless steel or special alloys. Shells may be fabricated of carbon, stainless or nickel-clad steel or copper silicon or other alloys.

INSTANTANEOUS WATER HEATER
Water Tube Type

ADSCO instantaneous heaters include: convertors, water heaters, condensate coolers, booster heaters, oil heaters, economizers, etc. . . . gravity or forced circulation . . . vertical or horizontal . . . steam or water tube type. Usual construction is steel shell with removable copper U-tubes. Thousands of these ADSCO heaters are in use today.

STORAGE HEATER

This heater, with removable U-tube element, can be furnished in either horizontal or vertical design. Shells are fabricated, per A.S.M.E. Code, of copper silicon alloy, stainless- or nickel-clad steel, galvanized or black carbon steel. ADSCO corrosion resistant treatment adds life to black steel tanks.

ASK ADSCO for expert engineering recommendations, drawings or estimates to meet your specific problems . . . or consult your nearest ADSCO representative. No obligation, of course.

ADSCO

EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
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AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.

NEW BOOKS & REPORTS

Piping Design Data Featured in Catalog

Catalog No. 211 of Tube Turns, Inc., Louisville 1, Ky., is, in effect, a combination catalog and engineering data book. It provides complete dimensional data, weights, and prices on the company's welding fittings and flanges. An engineering section contains illustrated information on these fittings and flanges under varying conditions of temperature, pressure, location, and materials processed. A section is also devoted to welding fittings and flanges in special metals and alloys, and includes information on the various services for which each type is best suited.

Probably the most noteworthy is the 60 page technical section which reflects the results of extensive research, calculations, and experiment. It contains data on the properties of pipe; rating of pipe, fittings, and flanges; line expansion and flexibility; supports and anchorage of piping; and flow of fluids. Much of the data, presented in the form of tables, is taken from ASA standards. All of it is organized and presented in a manner to simplify quick reference.

In the technical section on properties of pipe, dimensions of seamless and welded steel pipe are given. Another table, according to the company, is believed to be the most nearly complete tabulation of the dimensional properties of commercially available sizes of steel pipe ever published. In it are given not only the older standards of sizes and wall thicknesses, but also all of the schedule number sizes, including the new schedules of wall thicknesses for stainless steel pipe. This table also contains data on radii of gyration, moments of inertia, section moduli, and pressure/stress moduli for boiler code, power, district heating, refrigeration, oil, gas, and air piping. In the section on rating of pipe fittings and flanges, pressures, temperatures, and allowable stresses are tabulated, as are pipe wall thickness formulas.

In the section on pipe line expansion and flexibility, an approximate solution method is presented for certain elementary shapes. While it is essentially a square corner solution, its accuracy is said to be greatly enhanced by the inclusion of corrections, not only for the stress intensifications, but also for the compensatory increased flexibilities associated with curved members.

In a section devoted to the flow of fluids, a rational method (based on the Fanning equation) for determining pressure drop is given. Also given are data on equivalent lengths of fittings, viscosity conversions, specific volumes of gases, and dry saturated and superheated steam, together with empirical formulas for water, steam, and gas transmission.

Distribution of this 262 page, 9 × 11 in., clothbound catalog is being restricted to major users, designers, and erectors of industrial piping.

Air Conditioning Text Extensively Rewritten

Air Conditioning and Refrigeration, by Burgess H. Jennings, professor and chairman, department of mechanical engineering, Northwestern University, and Samuel R. Lewis, consulting engineer, stresses the essential fundamentals. The authors utilize concepts and examples from the viewpoint of basic principles rather than from

HEARD THE LATEST ABOUT "FLEETWELD 5"?

The world's favorite electrode is back in the limelight again!

Have you used "Fleetweld 5" lately? . . . or talked to any of the thousands of welders who are using this 21-year-old world's leading electrode?

Do so and you'll discover:

This star performer is still tops for *bead shape, lack of slag interference* and *penetration* . . . the qualities that have made it the leader for these many years in class E-6010 welding.

But the stellar attraction today is a *plus value* . . . its

New smoothness of operation

"Fleetweld 5" now has a smoother, *more unidirectional arc.* For every inch of rod, the *arc is confined,* directed right into the joint. *Burn-off is uniform* at all times. The arc is *easier to handle* at all currents and in all positions. Hence, it is easier to get *smooth, uniform beads* . . . every inch of the way. This uniformity gives improved weld metal too!

These new advantages for the veteran of the shielded arc process have been made possible by Lincoln's development of a new "uniformity control" in manufacturing.

Users everywhere are enthusiastic about *every inch, every rod, every shipment* of "Fleetweld 5". Try it and see how it gives *you* the answer to every problem in E-6010 welding!

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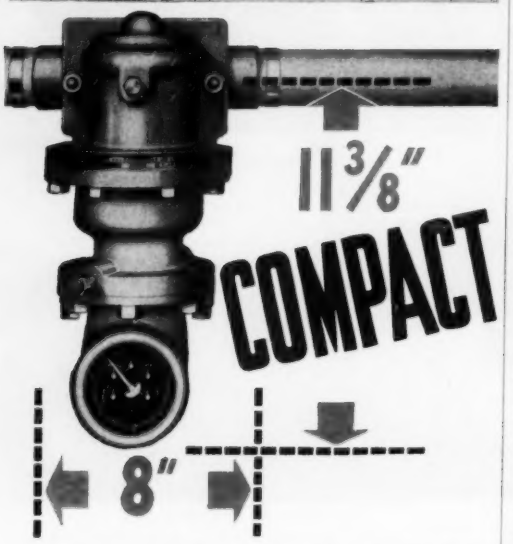
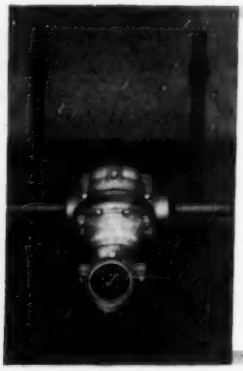
ANOTHER IMPORTANT FEATURE OF BUILDERS SHUNTFLO METER



Hold this magazine up to any 1" or 1½" pipeline with its top along the centerline of the pipe. That's all the space Builders SMDH Shuntflo Meter requires to give you positive quantitative readings on the flow through that line.

Whether it's steam, air, or gas, the SMDH Shuntflo Meter will tell you where and how much of these commodities is being consumed. It gives you readings in pounds or cubic feet — accurate within ± 2% of actual flow through the line. Compactness, simplicity of operation, and reliable accuracy account for the wide acceptance of Shuntflo Meters by district heating companies and other users of flow totalizing equipment. For engineering information and Bulletins 400-F1 and 400-F2, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.



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an empirical one. The book has been prepared with the assumption that readers have a knowledge of elementary thermodynamics, and accordingly calculus is used in certain derivations. Throughout, systematic presentation is the keynote, with engineering fundamentals illustrated by examples. Extensive tables of data and charts add much to the book.

The third edition, now off the press, has been extensively rewritten to include recent developments and newer technical data. The material on psychrometry has been completely rewritten and new psychrometric charts cover the range from low to high temperatures. New values of heat transfer coefficients are shown and additional heating and cooling application data are given. The chapters on warm air and steam heating have been rewritten and the material on air distribution incorporates the latest friction flow data and also covers the static regain method of duct computation. The information on boilers and combustion equipment has been expanded and an extended discussion of the heat pump and radiant heating is included.

Professor Jennings is a past president of the American Society of Refrigerating Engineers and Mr. Lewis is a past president of the American Society of Heating and Ventilating Engineers. He is also a member of HPAC's board of consulting and contributing editors and the author of a regular monthly feature in HPAC.

Containing 606 + xviii clothbound pages, this third edition is published by International Textbook Co., Scranton, Pa., and is priced at $6.50.

Finds Small Diameter Tubes in Heat Exchangers Give Good Performance

It has long been known that the size and spacing of tubes in a tube bank will affect the rate of heat transfer and the friction between the fluids and tubes. Data have been published by a number of investigators for turbulent flow of gases past tubes of various sizes in tube banks over a wide range of tube spacings. However, there are few data available for fluids in viscous flow through tube banks. Heat Transfer and Fluid Friction During Viscous Flow Across Banks of Tubes (III)—A Study of Tube Spacing and Tube Size, by O. P. Bergelin, associate professor, G. A. Brown, research fellow, H. L. Hull, research fellow, and F. W. Sullivan, all of the University of Delaware, is a report on part of a comprehensive program which will deal with variations in fluid properties as well as variations in dimensions of the tube bank.

In this paper, pressure drop and heat transfer data are reported for heating and cooling a medium viscosity oil flowing across banks of vertical tubes in seven test exchangers. The apparatus variables include equilateral triangle, in-line square, and staggered square arrangements; tube sizes of ⅜ in. and ¾ in. OD; and pitch ratios of 1.25 and 1.50.

Tentative correlations are provided for friction and heat transfer which bring the data for these seven tube banks somewhat closer together than previous correlations. In a comparison of the heat transfer coefficient versus the pumping power loss per unit surface area, smaller diameter tubes at the smaller pitch ratio gave the best performance.

This paper, No. 49—A-87, was presented at the recent annual meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

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Solve any dirt or dust problem with this complete line of electric air filters. Packaged units in 15 sizes. Larger or unusual installations engineered and custom built for any size, space or capacity.

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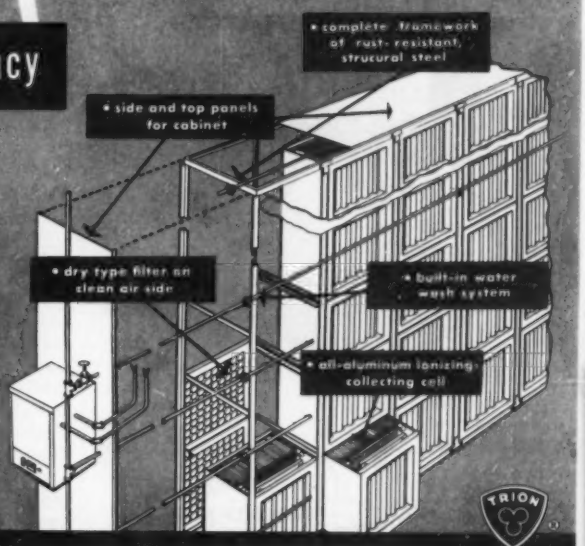
• complete framework of rust-resistant, strucural steel
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• dry type filter on clean air side
• built-in water wash system
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DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR ELECTROSTATIC CLEANING AND PURIFYING OF AIR AND OTHER GASES

AUTO-RAD CIRCULAR CONVECTORS

AN ENGINEERING TRIUMPH

- MADE TO ORDER
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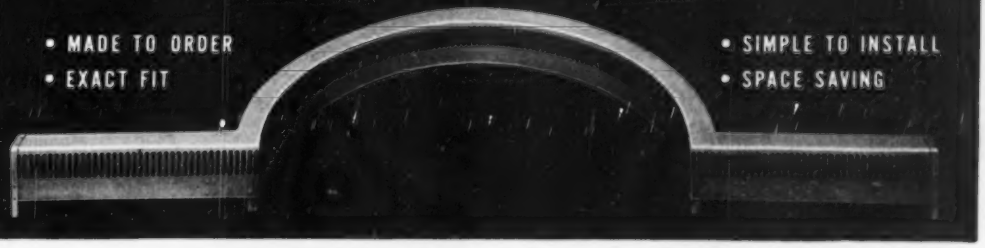

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The many possible applications of AUTO-RAD BASEBOARD CONVECTORS is proven by the development of Circular Convectors. Convectors can now be furnished to follow the contour of rooms, circular or rectangular. Auto-Rad Circular Convectors are made in any outside radius larger than 5' 3" (10' 6" circle) in heights of 7" containing one row of radiation. This convector is particularly adaptable to residential installations. These circular convectors are also made up to 45" high containing up to 8 rows of radiation for installations in hospitals, railway stations and other public buildings. Prices are quoted upon receipt of prints or templates. Write for the Auto-Rad layout sheet form AR-101 and Bulletin No. 50.

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ESTABLISHED 1920

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PIPE VISE

plus... a handy work bench

RIDGID Tristand's tray keeps all your tools in easy reach

● No stooping, less fatigue and speedier work now that you don't have to bend over every time you change tools. New tray attaches in a jiffy, makes Tristand rigid so it can't fold up in use. Legs have rubber feet to prevent creeping. RIDGID's LonGrip tool-steel jaws won't slip, won't mar polished pipe and tubing. Yoke vise, 2½" capacity; chain vise, 4." Buy new work-saver RIDGID Tristands from your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

Gives Up-To-Date Information on Oil Burners and Fuel Oil

The first edition of the book Oil Burners was published 13 years ago. Since then the technology of the oil burner industry has changed considerably. Though basic burner types are much the same, practically all aspects of their construction, installation, accessories, and control have altered radically. The chemistry and refining methods of the petroleum industry have undergone fundamental development and some important properties of fuel oil have thereby been affected.

A new second edition has been completely rewritten by the author, Kalman Steiner, consulting engineer, fuel engineer of C. Hoffberger Co., and a member of HPAC's board of consulting and contributing editors. Covering both underlying theory and engineering, as well as actual practice, the text deals with design, production, installation, operation, and maintenance of domestic, commercial, and industrial oil burners. Fuel oils are discussed in terms of characteristics, specifications, combustion, and handling. Basic information on electronics serves to introduce the use of such circuits in oil burner control. Other sections, either completely new or containing a substantial portion of new material, deal with capacities of boilers and warm air furnaces, refractories, draft and combustion control, the control of heating systems, and fluid flow.

The new second edition, clothbound and containing 502 + xx pages, is available from McGraw-Hill Book Co., 330 W. 42nd St., New York 18 for $6.50.

Other Books and Reports Received

Capillary Tubes—A Guide to Their Application on "Freon-12" Hermetic Condensing Units, by L. A. Staebler, director, refrigeration laboratory, Philco Corp. Identified as Application Data Section No. AD-48, the four page pamphlet describes the advantages of the capillary tube for certain applications, the theory of operation, and precautions to be observed in applying the tube. A table gives the approximate length and diameter of tube for different evaporator temperatures and motor horsepower. Copies are available for 35 cents from the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18.

Principles and Practice of Flow Meter Engineering, by L. K. Spink—The new seventh edition is available from Foxboro Co., Foxboro, Mass., for $7.00. Much new material has been added in this enlarged edition so as to make it an up-to-date treatise on all phases of flow engineering. Containing 416 pages of text and illustrations, information is given for calculating an orifice, flow nozzle, venturi tube, Pitot tube, or even a pipe elbow used for flow measurement. Common pressure tap locations are discussed and data are given to correct for odd tap locations. Liquids, steam or other vapors, and gas are handled in separate sections. Equations and curves for calculating throttling orifices to be used at critical pressure drops are a new addition to the book. Other new features include a section on measurements of fluid flow in metric units, a table of corrections for barometric pressures, a table of pressure multipliers up to 5000 psig, and a description of methods of applying the AGA gas measurement committee report No. 2.

Sound Construction

LET SKIDMORE BE YOUR GUIDE

"time tested favorite"

● Day in and day out dependability, year in and year out service. You can be sure that a Skidmore Pump will do the job efficiently. Every Skidmore Pump is built for a specific type of installation and backed by **sound construction.** Skidmore Pumps have been a favorite for over a quarter of a century.

Type UV Pump is built in either single or duplex units for handling below floor level returns. Type CV Vertical Condensation Pump is a compact unit used where space is limited and like others of the famous line of Skidmore Pumps, the CV Pump is designed for returning condensation to the boiler or other points.

Above: Type No. "UV"

Right: Type No. "CV"

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Skidmore Pumps

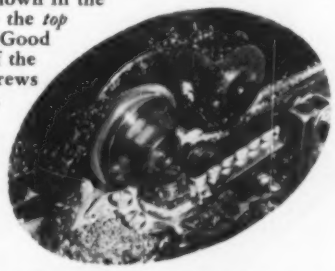
ST. JOSEPH, MICHIGAN

ELCO SLOTTING PUTS QUALITY IN "THE SCREWS YOU LIKE TO USE"

Slotting, done wrong, can sure mess up a run of screws that may be otherwise good. It is our aim at Elco to see that we *never* turn out screws with anything but *good* slots. We work to *close tolerances,* well inside of established standards. (Recently we ran a million or so little 3-48's for a switch manufacturer, on which the slots had to be more accurate and uniform than standard so that the screws could be picked up and started with a flat screwdriver.) Elco slots are carefully *centered,* and our slotters are equipped with built-in burring units for a *smooth* finish. Part of our slotting department is shown in the picture above — the *top* picture, that is. Good slotting is one of the signs of good screws — ELCO screws.

ELCO Screws

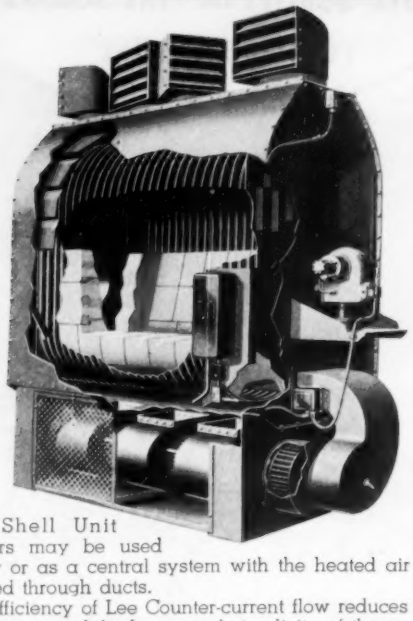
Making a Good Slot



This close-up shows one of our slotters in action, automatically turning out slots that are accurate, uniform, well-centered, and smooth.

ELCO TOOL & SCREW CORPORATION
1920 BROADWAY · ROCKFORD, ILLINOIS

LEE SHELL UNIT HEATER



Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.
The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The LEE line . . .
Steel Encased Tubular Heater
Tubular Unit Heater
Brick-Set Tubular Heater
Shell Unit Heater
Write now for more information

LEE ENGINEERING CO.
95 RIVER ST. HOBOKEN, N. J.

MEETINGS & CONVENTIONS

Warm Air Heating Conference—The 19th annual Forced Warm Air Conference will be held March 20 to 23 at Michigan State College, East Lansing, Mich.

Sponsored by the department of mechanical engineering in cooperation with the National Warm Air Heating and Air Conditioning Association, the affair will cover subjects such as heat loss calculations, ventilation, duct design, branch take-offs, fan selection and sizing, fuel consumption, and installation and service of oil and gas burners. Headquarters for the conference will be in Olds Hall of Engineering. The registration fee is $15.00. Additional information may be obtained from Special Courses and Conferences, Michigan State College, East Lansing 14.

National Association of Corrosion Engineers, 919 Milam Bldg., Houston 2—The 6th annual conference, Jefferson Hotel, St. Louis, April 4 to 7. Symposia under consideration include round table discussions on general corrosion problems and corrosion in connection with pipe lines, refrigeration and air conditioning, and the food industry.

The 12th Annual Midwest Power Conference—To be held April 5 to 7, Sherman Hotel, Chicago. The affair is sponsored by Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, with the cooperation of 18 midwestern universities and professional societies. Dr. E. R. Whitehead, director of electrical engineering at Illinois Tech, is conference secretary.

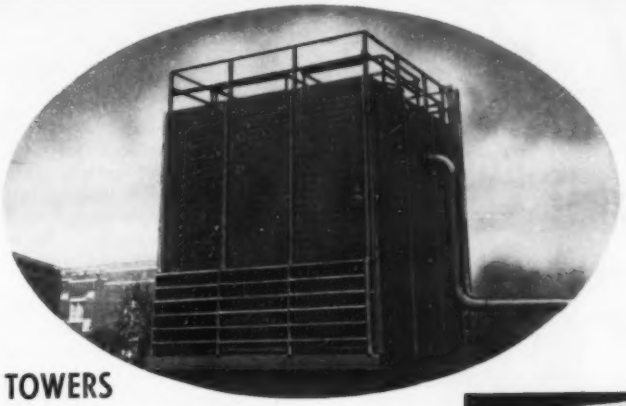
Over 50 technical papers are scheduled for presentation during 26 sessions. Some of them are:

Comparative Costs of Fabrication of Industrial Piping, by Charles Schott, chief engineer, Frank Fehr Brewing Co.
Standards of Performance for Heat Pump Cycles, by John F. Sandfort, associate professor of mechanical engineering, Iowa State College
Earth Heat Pump Research, by Estel B. Penrod, department of mechanical engineering, University of Kentucky
Development of Turbine Driven Centrifugal Refrigeration Machines and the Water Absorption Machine, by O. E. Gammill, Jr., Carrier Corp.
Technical Aspects of Air Pollution Abatement, by A. D. Singh, Singh Co.
Smoke Abatement Engineering, by H. B. Lammers, chairman, Coal Producers Committee for Smoke Abatement
Field and Laboratory Methods of Air Pollution Study, by Paul L. Magill, Supervisor, air and water pollution laboratory, Stanford Research Institute

American Society of Mechanical Engineers, 29 W. 39th St., New York City—Spring meeting, April 12 to 14, Hotel Statler, Washington, D. C. Semi-Annual meeting, June 19 to 23, Hotel Statler, St. Louis. Fall meeting, September 19 to 21, Hotel Sheraton, Worcester, Mass. Annual meeting, November 26 to December 1, Hotel Statler, New York City.

New Jersey Society of Professional Engineers, 86 E. State St., Trenton 8, N. J.—The 26th annual convention and an industrial, engineering, and commercial exhibit, April 14 and 15, Essex House, 1050 Broad St., Newark, N. J.

National Oil Heat Exposition, sponsored by the Oil-Heat Institute of America, Inc., 6 E. 39th St., New York



Left: United one cell induced draft tower, series M16, in ice plant refrigeration service.

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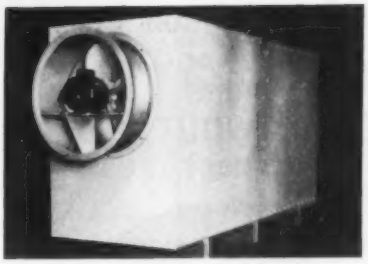
Complete line "package" type spray towers at low standardized prices.

Individually designed and constructed mechanical draft equipment in any required capacity.

Write for Bulletin No. 50 showing typical United installations in power, oil, gas and refrigeration service.



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4200 Series: Same as 4100 Series except cast iron tanks.

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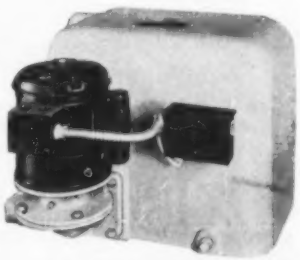
4126-B Condensation Pump (Steel Tank)



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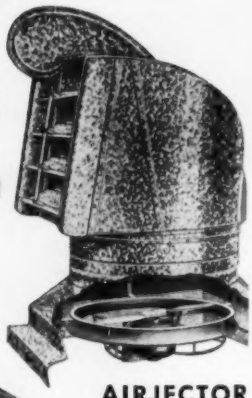
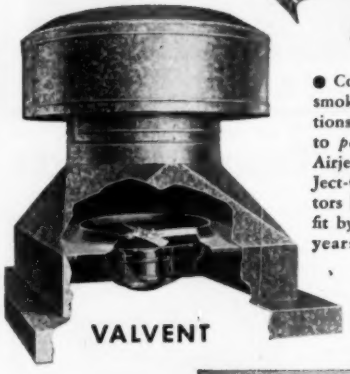


AIRJECTOR



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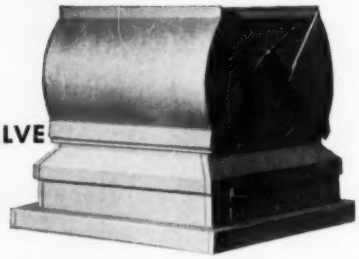

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Equipment for Controlled Air Circulation

16.—The affair will be held in conjunction with the 27th annual meeting of OHI, April 24 to 28. The exposition will be held in Commercial Museum, Philadelphia. Convention sessions and business meetings will be held at the Benjamin Franklin hotel.

American Gas Association, 420 Lexington Ave., New York City—The 1950 Research and Utilization Conference of the association will be held April 25 and 26 at the Hotel Statler, Cleveland. Gas appliance venting, ignition, and combustion will be covered in the various sessions. The AGA annual meeting will be held October 2 to 6, Atlantic City. The 1951 annual meeting is scheduled for October 15 to 18, St. Louis.

Sheet Metal Contractors Association of Illinois—Annual meeting and exhibit, State Armory Bldg., Springfield, Ill., April 27 to 29. George L. Folkers, 709 S. Adams St., Peoria 2, Ill., is convention exhibit chairman.

Heating, Piping, and Air Conditioning Contractors National Association, 1250 Avenue of the Americas, New York 20—1950 annual meeting, May 8 to 11, St. Francis hotel, San Francisco. Arrangements have been made with United States Travel Agency, Inc., 807 15th St., N.W., Washington, D. C., for a special sightseeing tour in connection with the convention.

National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6—The 41st annual meeting, Grove Park Inn, Asheville, N. C., May 23 to 26.

The Hotel Statler, Detroit, has been selected for the Society's 1951 annual meeting.

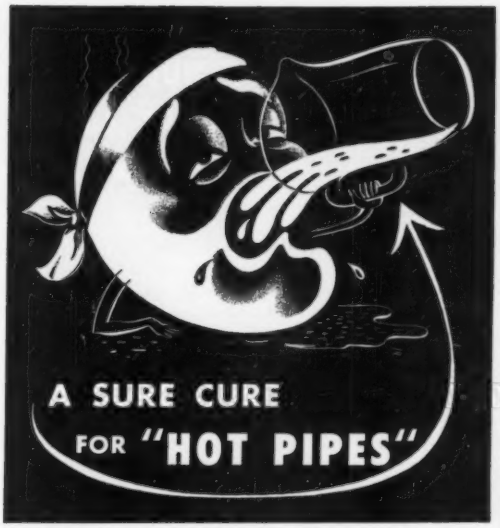
Midwest Refrigeration and Air Conditioning Educational Exhibit and Conference, May 25 to 28, Hotel Jefferson, St. Louis.—This is the first in a series of four sectional conferences sponsored jointly by the Refrigeration Equipment Manufacturers Association and the Refrigeration Service Engineers Society. The second in the series will be held in the Municipal Auditorium, Long Beach, Calif., November 17 to 19. Additional information may be obtained from the REMA public relations department, 1346 Connecticut Ave., N.W., Washington 6, D. C.

Canadian International Trade Fair—To be held May 29 to June 9, Exhibition Grounds, Toronto, Canada.

Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1—The 1950 annual meeting, to be held in Chicago, early in June.

American Society of Refrigerating Engineers, 40 W. 40th St., New York 18—The 37th spring meeting, June 4 to 7, Muehlebach hotel, Kansas City, Mo. Nine papers, grouped into one session of technical papers and two sessions of application type papers are scheduled.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10. Semi-annual meeting, Royal Muskoka hotel, on the Muskoka lakes, Ontario, Canada, June 19 to 21. The 1951 annual meeting will be held in Philadelphia, January 22 to 25 in conjunction with the 10th International Heating, Ventilating, and Air Conditioning Exposition.



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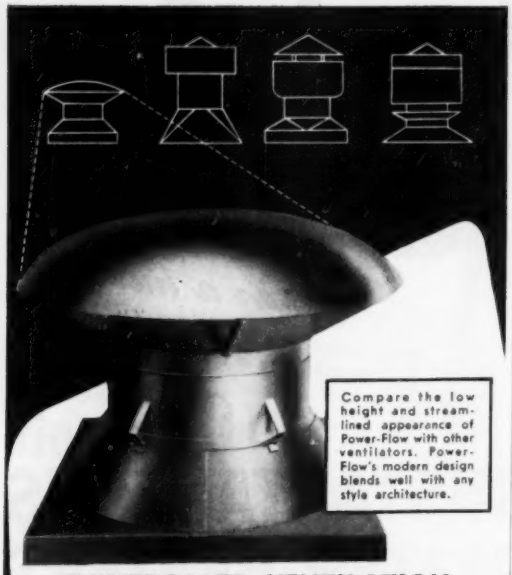
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For your convenience in obtaining copies of these bulletins, see coupon on page 185. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

HPAC 7564—AIR CONDITIONING UNITS—Designed for quick reference and use, Bulletin 409 of Marlo Coil Co., 6135 Manchester Ave., St. Louis 10, contains illustrations, simplified descriptions, dimensional data, capacities, and ratings of the firm's complete line of air conditioning units. Capacities of floor and suspended types range from approximately 2 to 150 tons.

HPAC 7565—AIR DIFFUSERS—In a new four page folder of Charles Demuth and Sons, Inc., Mineola, N. Y., seven models of air diffusers are briefly described and illustrated. Available sizes and recommended applications for each model are covered.

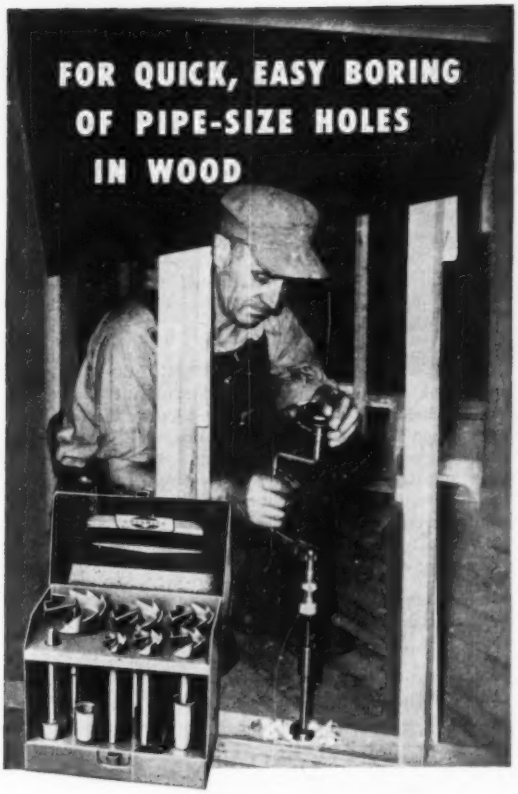
HPAC 7566—AIR VELOCITY METER—Catalog sheet No. 102 of Hastings Instrument Co., Inc., P. O. Box 1275, Hampton, Va., gives condensed information on its "Air-Meter," a portable anemometer designed to give direct readings of air velocities from 5 to 6000 fpm. Operation of the instrument is based on temperature differences. Catalog sheet No. 101 covers a similar "precision" instrument designed for use where multi-range scales and special probes are required.

HPAC 7567—ALLOY CASTINGS—The 1950 reference chart of Cooper Alloy Foundry Co., Hillside 5, N. J., contains a comprehensive analysis of stainless, corrosion, and heat resistant alloy castings. It covers in detail alloy types, the company's type numbers, as well as comparative designations of the Alloy Castings Institute, AISI, SAE, and ASTM. Properties of these alloys at room temperature and at elevated temperatures are also given, and applications are covered.

HPAC 7568—ALUMINUM PRODUCTS—An 18 page booklet on aluminum products has been released by Magnesium-Aluminum Div., Revere Copper and Brass Inc., 230 Park Ave., New York 17. The booklet contains descriptive material on the various forms fabricated and includes illustrations of products using alloys in the form of extruded shapes, tube, and coiled sheet. Also included is a comprehensive chart giving properties and characteristics of most of the firm's wrought aluminum alloys.

HPAC 7569—ARC WELDERS—Features and specifications of 10 different models of gasoline engine driven arc welders and combination models of arc welders and power units are given in a new four page folder released by Hobart Bros. Co., Troy, Ohio.

HPAC 7570—CEILING HEATING PANELS—The "Brad-Ray" warming system is said to be a simplified method of installing ceiling panels. Twenty-foot loops of 5/16 in. copper tubing or "Bundyweld" tubing are connected in parallel by means of saddle fitting headers placed along opposite sides of a ceiling joist. The headers



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Industrial application:

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Reduced by	73,980

Refrigeration savings = 6.15 tons

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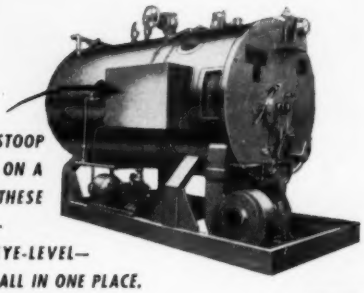

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HPAC 7571—CENTRIFUGAL, PISTON PUMPS—"Conseco" volute pumps are available in a wide range of types and sizes for numerous marine and industrial applications. They are described and illustrated in a 24 page catalog issued by Scranton Pump Div., Condenser Service & Engineering Co., Inc., 1445 Meylert Ave., Scranton, Pa. Piston pumps, recommended for boiler feeding, pumping light oil, and general service up to 150 psi, are also covered.

HPAC 7572—CHROMIUM CHEMICALS—A 32 page handbook on the general use and applications of chromium chemicals is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14. Information on bichromate of soda includes principal uses in numerous industries. Among the applications listed are uses as a corrosion resistant treatment of magnesium, tin plate, and aluminum, and as a means of inhibiting corrosion in water cooled or water circulating equipment. Information is also given on sodium chromate and bichromate of potash.

HPAC 7573—DUCT INSULATION—Circular No. 554 of Grant Wilson, Inc., 141 W. Jackson Blvd., Chicago 4, has been prepared to show the importance of insulating bare ducts with asbestos protected "Dux-Sulation."

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Fig. 0236
UNION BONNET — Renewable Nickel Alloy Seat Gate Valve — 200 lb. S.W.P.

Fig. U-01
Renewable Composition Disc Globe Valve — 150 lb. S.W.P.

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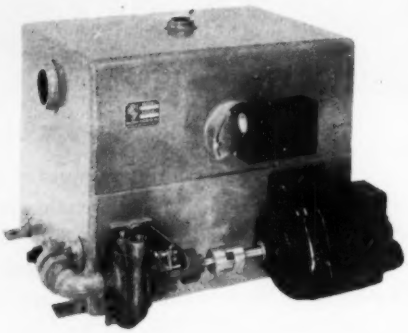

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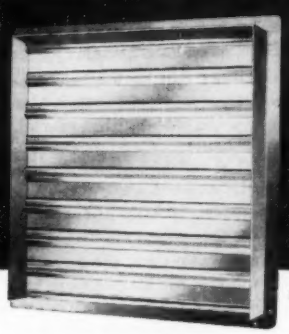
HPAC 7574—DUST COLLECTORS—A 16 page catalog (No. 250S-4) has been released by Prat-Daniel Corp., East Port Chester, Conn. on its new "Valmont" type S dust collector and also the standard type HC unit. The booklet contains information on the high narrow inlet slot, a feature of the type S collector which is said to increase collection efficiency in the range below 20 microns. A chart is included for determining the number of tubes required for a given capacity, temperature, and resistance. Copies of the catalog are available from Thermix Corp., Greenwich, Conn., project and sales engineers for Prat-Daniel.

HPAC 7575—FLEXIBLE PLASTIC TUBING—Bulletin T-77 of U. S. Stoneware Co., P. O. Box 350, Akron 9, Ohio, contains 24 pages giving detailed information on "Tygon" flexible plastic tubing. Applications, properties, and chemical resistant characteristics are covered. Sizes range up to 1 in. ID.

HPAC 7576—GLOBE, ANGLE STOP VALVES—Bulletin 501 of Edward Valves, Inc., subsidiary of Rockwell Mfg. Co., East Chicago, Ind., gives design details, dimensional data, material specifications, and list prices for the company's new Fig. 444 series globe and angle stop valves of drop forged steel construction. Valves are built in both 600 and 1500 lb classes and are available with either bolted or union bonnets and with either screwed or socket welding ends.

they all want **AIR-FLO**



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

FRONT VIEW—CLOSED

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

WRITE FOR NEW AIR-FLO CATALOG 43-D

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.

2340 W. LAFAYETTE BLVD. · DETROIT 16, MICH.

COMPRESSIBILITY *is what you buy ...so be sure you get it*

Quick compression under stress — that's the *one* most important job of an expansion joint. Ordinary "stiff" joints transmit rather than absorb movement — strain and break adjacent fittings, equipment and pipe moorings.

Not so with Badger Directed Flexing Packless Corrugated Expansion Joints. From beginning to end of fabrication, Badger Engineers consider compressibility *first*. Corrugated member is formed by an exclusive Badger Manufacturing Company process which maintains maximum flexibility without introducing structure-weakening stresses. The flexing member is carefully heat-treated — once again by exclusive methods — to bring the metal to a state where it will resist fatigue yet react quickly to movement. Finally, the entire joint is inspected to make certain that *freedom* of movement is maintained under stress.

By such manufacturing methods as these, Badger Expansion Joints have become the standard by which all others are measured. Remember this when you specify.

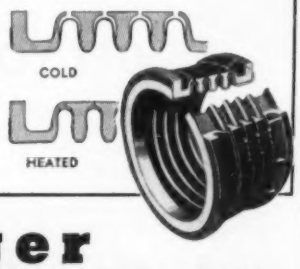
Send today for new 24-page catalog

All-curve flexing guarantees longer life

Badger Joints flex like this . . .

not like this . . .

EXCLUSIVE construction of Badger Joints eliminates localized flexing stresses that cause breakdowns. Directed Flexing Equalizing Rings control and contain movement to *all-curve* pattern — distribute stresses to all parts of flexing member.



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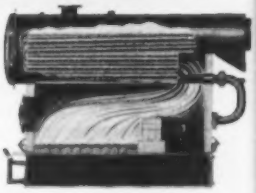
MANUFACTURING COMPANY
230-260 BENT STREET CAMBRIDGE 41, MASS.

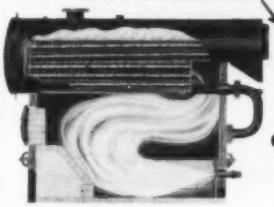
TITUSVILLE
Compact All Welded
HIGH FIREBOX
STEEL HEATING BOILERS

Cutaway view to show Type CC Compact Boiler (hand fired)

1. Large Grate Area
2. Large Furnace Volume
3. Large Disengaging Area
4. Large Steam Volume
5. Long Heat Travel



These Features Assure More Savings in Fuel and Maximum Heat Output



1. Long Flame Travel
2. Max. Furnace Volume
3. Reasonable Heat Release
4. Highest Efficiency
5. Longest Life

Cutaway view to show Type CM Compact Boiler (mechanically fired)

Write for complete informative Bulletin B-3000B for CM & CC Types

Titusville manufactures a Complete Line of High and Low Pressure Fire and Water-tube Boilers to meet all capacity and pressure requirements. *Request bulletin "Meet the Titusville Family."*

THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PENNA.
Representatives in Principal Cities

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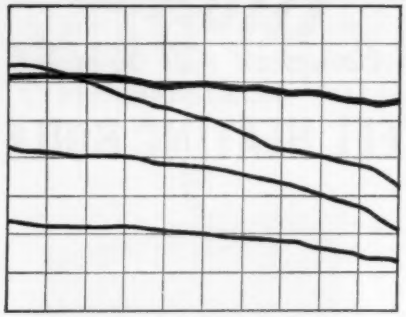
THE LOWDOWN ON INSULATION



Efficiency is as efficiency does

Remember the old saying—"Handsome is as Handsome does"? Just change that word "handsome" to "efficiency," and you're talking about low-temperature insulation.

The smart insulation buyer realizes that theoretical or laboratory efficiency isn't the whole story, by any means. He wants his insulation to keep on delivering efficiency in his cold-room walls.

One of the grand things about Novoid Corkboard insulation is the dependable way it stays efficient year after year in actual service. Our customers keep coming back for more. (Satisfaction—not force of habit—is the reason for that.)

Of course, Novoid Corkboard is made here in the United States, under strict quality control. And it's installed by some of the most experienced, dependable men in the business. It's about as good a way to keep refrigeration costs down as you can possibly find. If conflicting insulation claims are bothering you, just write to us. We'll be glad to send you the "lowdown." Novoid Cork, Englewood, N. J.

Consider EVERY factor when you buy insulation

Check list of insulation properties

	Novoid Cork Insulation	Many Other Insulations
First cost	moderate	low to high
Installation cost	low	moderate to expensive
Eventual cost	low	high
Efficiency	remains high	generally deteriorates
Moisture resistance	excellent	some good, some poor
Vapor seal	simple	complicated or difficult to install
Structural strength	very good	some non-existent, others fair
Weight	very light	varies
Resilience	considerable	from fair to complete rigidity
Settling	none	a serious problem
Supporting structure	none	elaborate
Fire resistance	good	excellent to poor
Vermin resistance	good	excellent to very bad
Odor absorption	none	some are regular sponges

HPAC 7577—INSULATED PIPING SYSTEM—Ric-Wil Co., Dept. J-1, Union Commerce Bldg., Cleveland, has released two new technical data books. Catalog section 480-4 illustrates and describes the manufacture, construction, and installation of various types of insulated piping available from the company. Technical data on piping systems and services available from the company are also included in this general catalog. Catalog section 480-5 contains illustrated technical data and specifications on all phases of the firm's insulated piping, its structures, properties, and installation procedures.

HPAC 7578—LEAK DETECTOR—Recommended for use wherever a vacuum, fixed pressure, or special atmosphere must be maintained for extended periods of time, the "Veeco" mass spectrometer leak detector (model MS-2) is described in Bulletin LD-48 of Vacuum-Electronic Engineering Co., 316 37th St., Brooklyn 32. Principles of operation, applications, and features are covered and data are given on vacuum and pressure testing.

HPAC 7579—MOTOR CONTROLS—The fourth edition of its reference book on motor controls has been prepared by Allen-Bradley Co., Milwaukee 4. The 76 page booklet gives condensed information on design and construction features, operation, applications, etc. Dimensions and prices are also included. Requests for copies should be addressed to the manufacturer on company letterheads.

HPAC 7580—PACKAGED BOILER—The "Power Gems" packaged steam generator of Edge Moor Iron Works, Inc., Edge Moor, Del., is described and illustrated

GET YOUR COPY

Our new *Unitbilt* Boiler-Stoker Combinations are fully described and illustrated in Bulletin No. SF-1. It contains complete engineering and dimensional data. A copy will be gladly sent upon request. Clip this advertisement or make a memorandum to write us.

The BROWNELL Co.
408 N. Findlay St., Dayton 1, O.

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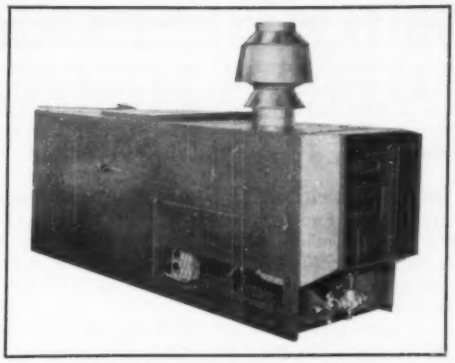
CENTRAL GAS HEATER

(Forced Air Type)



COMPARE THESE SUPERIOR FEATURES:

1. Neat, attractive cabinet.
2. Large, efficient heat exchanger.
3. Single orifice slotted burner.
4. Capillary type fan control & capillary type high limit control.
5. Large oversize blower runs at low speed with ⅓ HP motor.
6. Two large oversized filters pick up loose dust particles and keep circulated warm air "vacuum cleaned."
7. Automatic safety shut-off.
8. Warm Air discharge.

UNIT HEATERS

Whisper Quiet Model

WHISPER QUIET MODEL

For installations requiring quiet operation. More Head Room—Compact Design and More Heat From Gas Burned. A. G. A. approved for natural, manufactured, mixed or LP gases. Fully equipped with Automatic Controls.

HURRICANE MODEL

For Industrial Installations. This model is also compact in design, offering more Head Room and More Heat from Gas Burned. Will heat 40' x 80' space. A. G. A. approved for natural, manufactured, mixed or LP gases. Automatic Controls.

100,000 Btu/hr.

Both Models finished in Toast Tan Crinkle Enamel Baked on. Adjustable Louvers.

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Erupting every 65.6 minutes, Old Faithful spouts a quarter-million gallons per day in an impressive display of Nature's "pumping" power. The same volume of water can be delivered in less than 9 minutes by an ECONOMY Double Suction Pump.

From 50 to 30,000 gallons per minute, there are more than 1500 Ratings of this Economy Double Suction Pump . . . to meet your requirements for any capacity at heads to 300 feet. Designed for general purpose pumping of clear liquids at moderate heads, these single stage units are suited to general water supply or heavy mill service.

Sound hydraulic design give these Economy Pumps a broad, flat efficiency curve over a wide capacity range. Minimum maintenance is assured by sound engineering—based on such advantages as:

- Easy removal of complete rotor without exposing bearings.
- No leakage between sleeve and shaft . . . shaft sleeves are sealed.
- Flanged wearing rings, "L" shaped, inward flow.
- Unusually effective water seals.
- Large wells for lubrication.

If you wish full details, our Dept. C-3, will gladly send you Catalog A-1147.

Economy Pumps Inc.

DIVISION OF HAMILTON THOMAS CORP. HAMILTON, OHIO

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"JOT THIS CHANGE DOWN"

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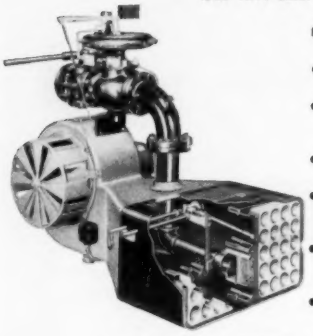
EXPERTO CREDE

"Fan-Air Gas Burners"

Here Is the 1950 Model No. 42F-3
(500 H.P. Size)



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- Spark Ignited Pilot
- Electronic Flame Guarded Equipment
- Automatic Fuel Controls
- 100% Shutoff on Flame Failure
- Packaged & Tested at the Factory
- S.A. Oil Burner

WRITE FOR ADDITIONAL DETAILS

in Bulletin G-491. Automatic units are offered in capacities from 20 to 500 hp and are available with burners for utilizing heavy oil, light oil, or gas. The booklet gives detailed information on these boiler units which are of welded steel four pass, horizontal, fire tube modified Scotch marine design.

HPAC 7581—PIPE LINE SEPARATORS—Diagrams, line drawings, specifications, and selection and ordering data are included in a new 12 page bulletin (No. S-14-C) on pipe line separators for removing unwanted elements (such as water and oil) from steam, air, and other vapors. The manufacturer is Swartwout Co., 18511 Euclid Ave., Cleveland 12.

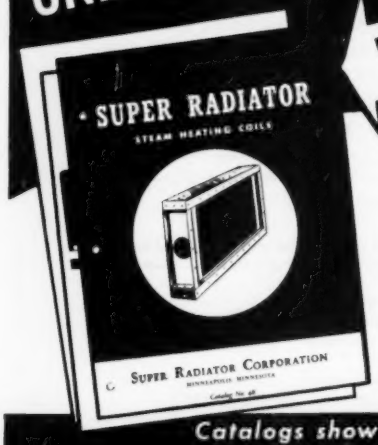
HPAC 7582—PRESSURE BLOWER—The "Standard-aire" blower, for pressure or corresponding vacuum service, is available from Standard Stoker Co., Inc., 370 Lexington Ave., New York 17. Units for service at pressures up to 20 psi and having capacities up to 10,000 cfm are covered in Publication 86.

HPAC 7583—PROPELLER FANS—The complete line of propeller type fans of Emerson Electric Mfg. Co., St. Louis 21, is illustrated in color and described in detail in a new catalog (Unit X6549). Design and construction specifications, together with performance data, are given on various types of desk and stand fans, air circulators, ceiling fans, exhaust fans, window fans, etc.

HPAC 7584—REFRIGERANTS—Why Use "Freon" is the title of a new folder issued by Kinetic Chemicals, Inc.,

ONLY SUPER RADIATOR COILS HAVE IT!

READ THE STORY!
EXCLUSIVE PATENT



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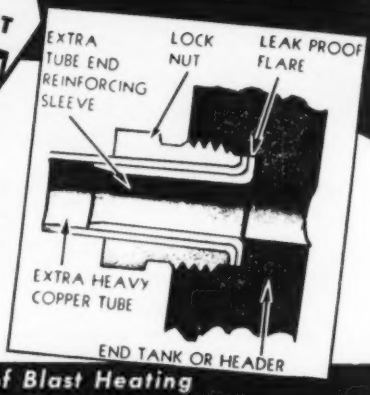
Originally developed to provide a positive and leakproof assembly for 300 lbs. steam service—now available on all Super Radiator coils—*at a cost comparable to that of ordinary coil construction.* Write today—learn why Super Radiator means a better coil for every application!



Catalogs show our complete Line of Blast Heating and cooling coils for Every Application

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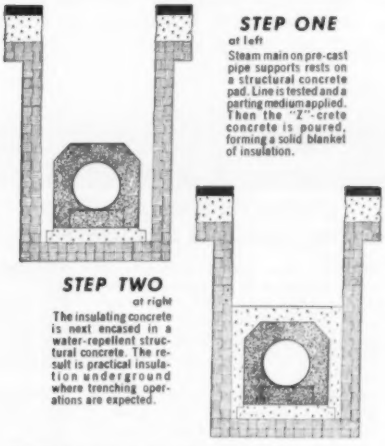
FAST! SIMPLE! ECONOMICAL! EFFICIENT!

ARMORED INSULATING CONDUITS FOR HEAVY TRAFFIC AREAS

USING "Z"crete

Cast-in-Place Insulation

The simplest yet most efficient solution to installations where traffic loads exist or where streets are frequently torn up. Ideal for underground installations because it will not disintegrate or deteriorate from wetting, exposure or electrical currents. "Z"-crete is permanent.



STEP ONE
at left
Steam main on pre-cast pipe supports rests on a structural concrete pad. Line is tested and a parting medium applied. Then the "Z"-crete concrete is poured, forming a solid blanket of insulation.

STEP TWO
at right
The insulating concrete is next encased in a water-repellent structural concrete. The result is practical insulation underground where trenching operations are expected.

"Z"-crete Insulating Concrete

Specially graded and mixed for underground insulation of steam, hot water and processed liquids. Furnished and installed by authorized applicators under rigid supervision. Write today for full information.

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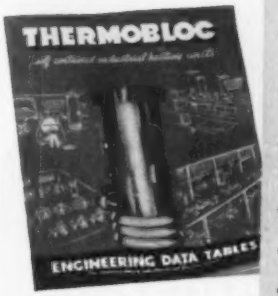
ZONOLITE COMPANY
135 S. La Salle St., Dept. HP-30, Chicago 3, Illinois

BEST ALL ROUND FOR YOUR UNDERGROUND!

Here's information you've been Looking for!



- Official Design Temperatures for all states and localities.
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THERMOBLOCS are made in two standard sizes, designed to heat the area they serve without duct work or other means of distribution. You'll be amazed at the low initial cost and the economy—realized by heating industrial structures this new, simple way.

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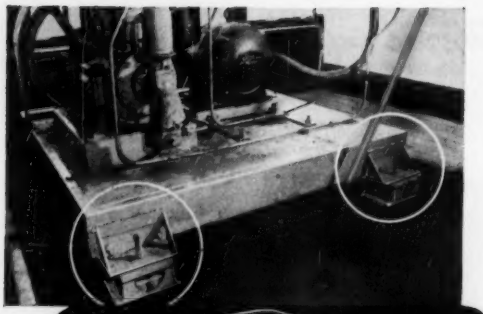

Third Floor Installation MADE PRACTICAL ...by KORFUND

Locating air conditioning equipment anywhere above the ground floor presents problems, mainly because of excessive vibration and noise in operation. Korfund Standard Vibro-Isolator Units have solved this problem many times.

For example, Valley Weathermakers, Harlingen, Texas, recently installed a reciprocating compressor on the third floor of S. H. Kress & Co. building, Brownsville, Texas. In this instance, installation was made even more difficult by location near the offices and sales floor. Yet today the 2300 lb. compressor and 900 lb., 40 HP motor are operating satisfactorily mounted on four Korfund LK/F Vibro-Isolators. Valley Weathermakers' letter states:

"... These isolators are doing an excellent job of removing vibration caused by the motor and compressor. You can stand in the office directly below the equipment and not be able to tell whether or not (it) is in operation ... The Construction Superintendent for S. H. Kress & Co. ... was very much pleased ... (In another case) we have an air conditioning compressor installed on the second floor of an office building, and it is disturbing the tenants below. From the results of the Brownsville, Texas, job, we feel sure that your Isolators will remedy the trouble on this installation."

It is interesting to note that more than 75% of Korfund orders in the air conditioning field are *repeat* business. We'll be glad to send further details showing why this is so. Write us today about your problems in Vibration Control.

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Specialists in
Vibration Control for Over 45 Years
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10th and Market Sts., Wilmington 98, Del. Ten characteristics of these refrigerants are described as outstanding advantages. Illustrations are used to show some of the laboratory procedures used to control manufacture.

HPAC 7585—REFRIGERATION OILS—The use of the floc test in evaluating the waxing tendency of refrigeration oil is briefly described in a four page booklet issued by Sun Oil Co., Philadelphia 3. Low wax quantities of "Suniso" oils are stressed.

HPAC 7586—SAFETY SWITCHES—A new folder, (TEC-10) gives the latest information on HCI (high capacity interrupter) safety switches of Trumbull Electric Mfg. Co., Plainville, Conn. These new switches, designed for use in industrial distribution systems, are described as having unusually high interrupting capacity, extremely high momentary current capacity, and the ability to handle short circuits without damage.

HPAC 7587 — SELF CONTAINED BOILERS — Cleaver-Brooks Co., 326A E. Keefe Ave., Milwaukee, has issued a 12 page bulletin on its self contained, oil and gas fired steam boilers for processing and heating. Illustrated are various sizes of steam generators ranging from 15 to 500 hp and designed for pressures from 15 to 200 psi. A diagrammatic cross section illustration shows the four pass design of the units.

HPAC 7588—SELF LOCKING NUTS—Palnut Co., 61 Cordier St., Irvington, N. J., has released a four page folder on its self locking nuts. Two case histories are

For Domestic & Industrial use

EXTREMELY ACCURATE, SENSITIVE HEATING, COOLING & PRESSURE CONTROLS

TYPE U—Room Type Thermostat for Domestic Installations is an adjustable control calibrated from 54° to 84° F, 75° to 105° F or 30° F to 60° F. Differential is fixed 2° F. Electrical rating 15 amps 125/250 V AC. Also offered with tamper proof cover for industrial installation.

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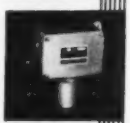
TYPE LR—A highly sensitive pressure-vacuum control offering very close differentials of from 6" wc to 1½ psi. Controls are adjustable over varying ranges between limits of 0 to 180 psi and 30" hg vac to 0. Rated electrically at 125/250 V AC.



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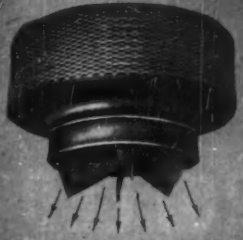
All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



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A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

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COOLING TOWERS

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For use with any air conditioning or refrigerating unit

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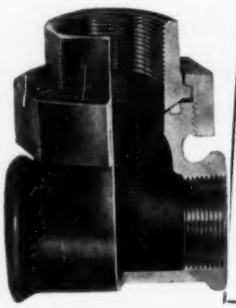

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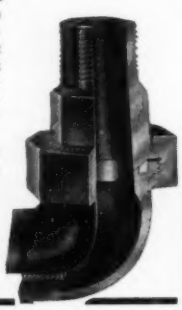
★ before shipment.

A trial order will convince you and we'll be glad to service you in a hurry. Just write today to the address below.



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65 Gooding Street, Lockport, N. Y.

used to show applications with respect to an inclined grate cooler and shop assembled boilers.

HPAC 7589—SMALL MOTORS—Booklet B-3075-C of Westinghouse Electric Corp., Box 2099, Pittsburgh 30, deals with small motor selection. Information is given on why there are different types of fractional horsepower motors and the factors to be considered in selecting the right motor for a given application. The center pages, which open to form a large chart, present in tabular form the various types of small motors available from the company, together with data on horsepower range, speed characteristics, torque, reversibility, bearings, mountings, applications, etc.

HPAC 7590—SOCKET SCREWS—Bulletin 490 of Parker-Kalon Corp., 200 Varick St., New York 14, contains data on the company's socket screws, both high tensile alloy and stainless steel types, together with a list of standard sizes for each type. Stripper bolts, pipe plugs, and hexagonal keys are also covered.

HPAC 7591—STEAM GENERATORS—York Shipley, Inc., York, Pa., has issued seven new pieces of literature giving design and construction features, dimensions, and capacities of its complete line of packaged "Steam-Pak" generators. Bulletins ID-49-39, ID-49-40, and ID-49-43 respectively cover 15 to 150 hp units designed for use with No. 5 fuel oil, combination firing of No. 5 fuel oil and gas, and gas firing. Bulletins ID-49-41 and ID-49-42 deal respectively with 15 to 100 hp units designed for use with No. 3 oil and combination firing of No. 3 fuel

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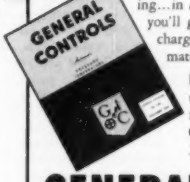

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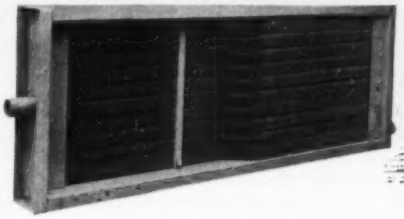

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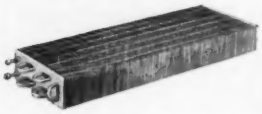

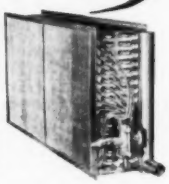

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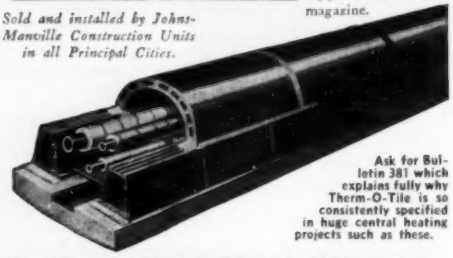

Ask for Bulletin 381 which explains fully why Therm-O-Tile is so consistently specified in huge central heating projects such as these.

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oil and gas. Bulletins ID-49-37 and ID-49-38 respectively describe 50 to 150 hp generators designed for use with No. 6 oil and combination firing with gas and No. 6 oil.

HPAC 7592—STEAM JET AIR EJECTORS—Principles of operation, design and construction features, and special applications of "Conseco" steam jet air ejectors are covered in a new bulletin released by Condenser Service & Engineering Co., Inc., Seaboard Trust Bldg., Hoboken, N. J. Data on accepted normal air leakage for various size plants are included.

HPAC 7593—SYNCHRONOUS MOTORS—Publication GEA-5426 of General Electric Co., Schenectady 5, N. Y., is an eight page bulletin on "Tri-Clad" highspeed synchronous motors. Various applications such as driving pumps, grinders, compressors, fans, generators, etc. are listed and three typical installation stories are included. Motors described are rated from 20 to 1500 hp at 60 cycle speeds of 1800 rpm, as well as proportional hp ratings for speeds through 514 rpm.

HPAC 7594—TEMPERATURE CONTROLS—A new folder prepared by Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville 4, Tenn., utilizes over 30 diagrams to show applications for the firm's modulating temperature controls. Heating, ventilating, and air conditioning applications are described, as are some 20 regulating valves and thermostats.

HPAC 7595—TRASH AND SEWAGE PUMP—A recently announced pump for handling trash and sewage

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Pipe joints sealed with Key-Tite positively will not leak. It is a perfect seal on all lines carrying water, gas, low-pressure steam, compressed air, etc. It contains no lead or lead substitutes and does not affect the taste or color of potable liquids. Key-Tite positively will not freeze in the joints . . . they may be easily opened.

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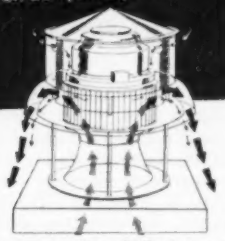

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The Gallaher Power Exhauster is the answer. Motor OUT of airstream and motor hood under constant negative pressure of fresh air, prevents formation of explosive or corrosive fumes.

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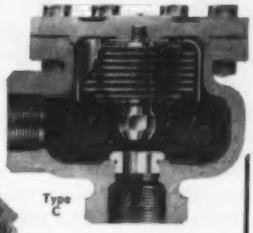

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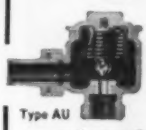

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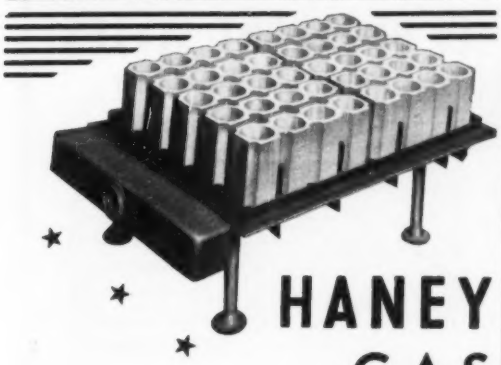

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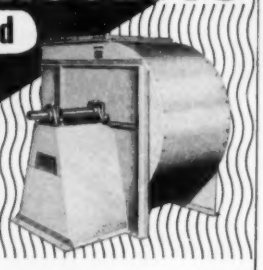
is covered in Bulletin 5400K-1 of Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5. The outstanding feature is said to be the bladeless impeller design. Details on design, construction, drive modifications, and performance are given, along with principal dimensions, selection tables, and typical specifications.

HPAC 7596—UNDERGROUND PIPING INSULATION—The Z-Crete Div., Zonolite Co., 135 S. La Salle St., Chicago 3, has prepared a revised edition of its booklet on the company's lightweight resilient concrete used for the insulation of heated piping installed underground. The firm's method of insulating hot lines with a continuous system of insulating concrete is described and illustrated.

HPAC 7597—VACUUM GAGE, ELECTRONIC CELL—Utilizing a noble metal thermopile and bridge circuits, the vacuum gage of Hastings Instrument Co., Inc., P. O. Box 1275, Hampton, Va., is designed for a range of 1 to 1000 microns of mercury. Recommended for numerous applications, including refrigeration service, vacuum dehydration, leak detection, warning devices, and pressure operated control systems, it is briefly described in catalog sheet No. 104. The firm's electronic standard cell is a d-c voltage supply designed for use with self balancing potentiometers, recording oscillographs, resistance thermometers, and other laboratory and industrial instruments. It is covered in catalog sheet No. 103.

HPAC 7598—VARIABLE SPEED MOTOR DRIVE—Reliance Electric & Engineering Co., 1111 Ivanhoe Rd.,

MASSACHUSETTS
Squirrel Cage and Power Fixed FANS



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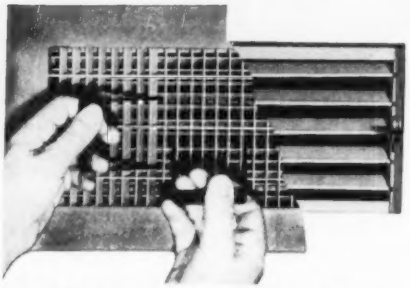

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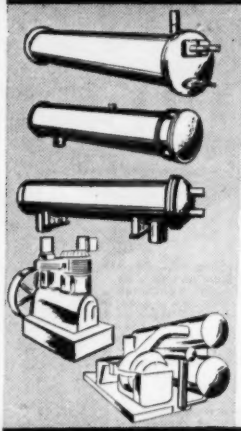

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Cleveland 10, has designed a new all-electric variable voltage type of adjustable-speed motor drive. It is designed to operate on a-c current and is currently offered in sizes of ¾, 1, 1¼, and 2 hp. Numerous applications stressed by the company include variable flow pumps, centrifuges, and machine tools. Bulletin D-2101 gives detailed information.

HPAC 7599—WELDING ELECTRODES—Catalog EW-149 of Hobart Bros. Co., Troy, Ohio, covers the firm's line of electrodes for welding mild steel, cast iron, stainless steel, steel and nonferrous alloys, etc. In addition to describing electrode identifications and providing information on applications and recommended welding procedures, the booklet gives data on physical properties.

HPAC 7600—WELDING RODS & ELECTRODES—A two color wall chart (2 ft x 3 ft) has been prepared by Eutectic Welding Alloys Corp., 40 Worth St., New York 13. The chart lists over 100 "Eutectrods" and "Eutectrodes" with their standard sizes, giving for each rod such technical data as type of joint for which suitable, metal on which used, bonding temperature, tensile strength, electrical conductivity, resistance to corrosion, flame adjustment, etc.

HPAC 7601—WETTER WATER—PN-700 is a chemical conditioner developed by Service Industries 2103-05-07 E. Somerset St., Philadelphia 34, to "make water wetter" by increasing its penetrating and dissolving power. A four page folder describes the many applications stressed by the company. These include cleaning air conditioning system filters, washing ferrous and nonferrous metals, cleaning aluminum and nonferrous metals in preparation for painting or plating, and improving the efficiency of cutting oils and coolants.

HPAC 7602—WOODEN BEARINGS—A new engineering manual dealing with the principles and applications of oilless wooden bearings in machine design has been published by Paramount Oilless Bearing Co., Worcester, Mass. Applications covered include air conditioning and heating devices where the bearing and lubricant are subject to continuous or alternating high and low temperatures, equipment where bearings must withstand moisture and corrosive action, etc. The manual is being loaned to accredited engineers and machine designers on request.

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FORCED AIR
REGISTERS and
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◀ Illustrates how easy it is to set the bars with a "Bend-Ezy" tool.

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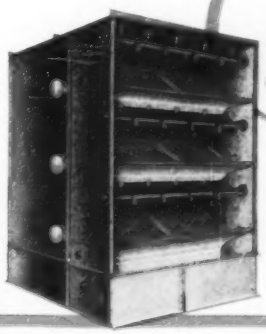

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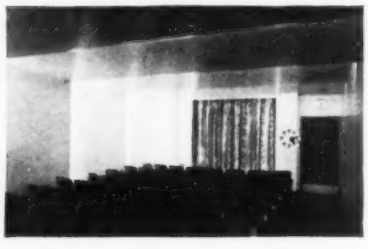

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